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# Preliminary Assessment of the Ecological Risks to Wide-ranging Wildlife Species on the Oak Ridge Reservation

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# PREFACE

This report, *Preliminary Assessment of the Ecological Risks to Wide-ranging Wildlife Species on the Oak Ridge Reservation,* DOE/OR/01-1407&D1, was prepared as a technical report documenting work performed under the Oak Ridge Reservation Ecological Assessment Program. This work was performed under work breakdown structure 1.4.12.2.3.4 (activity data sheet 8304, 'Technical Integration'). Publication of this document meets an activity data sheet milestone of August 31, 1995. This document provides the Environmental Restoration Program with a preliminary evaluation of the ecological risks that contaminants on the Oak Ridge Reservation present to selected wide-ranging species. These results will aid in the understanding of the magnitude of ecological risks to populations at larger spatial scales and will assist in the prioritization of source operable units for investigation and remediation.

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# ACRONYMS

| | |
|---|---|
| BEIDMS | Bechtel Environmental Information Data Management System |
| BCK | Bear Creek Kilometer |
| BCOU | Bear Creek Operable Unit |
| BMAP | Biological Monitoring and Abatement Program |
| CERCL | Comprehensive Environmental Response, Compensation, and Liability Act |
| COPECs | Chemicals of Potential Ecological Concern |
| CR | Chestnut Ridge |
| DQO | Data Quality Objectives |
| DOE | United States Department of Energy |
| EFPC | East Fork Poplar Creek |
| EFK | East Fork Kilometer |
| EMAP | Ecological Monitoring and Assessment Program |
| EPA | Environmental Protection Agency |
| ESD | Environmental Sciences Division |
| ER | Environmental Restoration |
| EROD | Ethoxyresorufin-o-deethylase |
| FFA | Federal Facilities Agreement |
| FS | Feasibility Study |
| GIS | Geographic Information System |
| HQ | Hazard Quotient |
| MEK | Melton Branch Kilometer |
| MIK | Mitchell Branch Kilometer |
| NOAEL | No Observed Adverse Effects Level |
| NTK | Northwest Tributary Kilometer |
| LEFPC | Lower East Fork Poplar Creek |
| LOAEL | Lowest Observed Adverse Effects Level |
| OREIS | Oak Ridge Environmental Information System |
| ORR | Oak Ridge Reservation |
| OU | Operable Unit |
| PCB | Polychlorinated Biphenyl |
| PLE | Product Limit Estimator |
| RI | Remedial Investigation |
| SAIC | Science Applications International Corporation |
| SCF | South Campus Facility |
| ∑Tus | Sum of Toxic Units |
| STD | Standard Deviation |
| TDEC | Tennessee Department of Environment and Conservation |
| T&E | Threatened or Endangered |
| TWRA | Tennessee Wildlife Resources Agency |
| UEFPC | Upper East Fork Poplar Creek |
| UCL | Upper Confidence Limit |
| WAG | Waste Area Grouping |

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# EXECUTIVE SUMMARY

Historically, ecological risk assessment at CERCLA sites [such as the Oak Ridge Reservation (ORR)], has focused on species that may be definitively associated with a contaminated area or source operable unit. This is necessary to identify areas where risk is sufficiently high to warrant remediation. Consequently the species that are generally considered are those with home ranges small enough such that multiple individuals or a distinct population can be expected to reside within the boundaries of the contaminated site. This approach is adequate for sites with single, discrete areas of contamination that only provide habitat for species with limited spatial (e.g., small home range) requirements. This approach is not adequate however for large sites with multiple, spatially separated contaminated areas that provide habitat for wide-ranging wildlife species. Because wide-ranging wildlife species may travel between and use multiple contaminated sites they may be exposed to and be at risk from contaminants from multiple locations. Use (and therefore exposure and risk) of a particular contaminated site by wide-ranging species will be dependant upon the amount of suitable habitat available at that site. Therefore to adequately evaluate risks to wide-ranging species at the ORR-wide scale, the use of multiple contaminated sites must be weighted by the amount of suitable habitat on OUs. Highly contaminated OUs that provide little habitat are unlikely to be significant contributors to ORR-scale risk. Conversely, moderately contaminated sites that contain considerable habitat may significantly contribute to ORR-scale risk.

In spring of 1994, a series of meetings were held among the FFA (Federal Facilities Agreement) parties to develop an approach and plan for assessing risks to wide-ranging species that could not be adequately addressed at the source OU level. The results of these discussions are presented in the ORR ecological risk assessment strategy document (Suter et al. 1994a). This report is based upon this document and presents the preliminary assessment of ecological risks to wide-ranging species from contaminants on the ORR.

The reservation-wide ecological risk assessment is intended to serve several purposes. These include: (1) identifying which endpoints are significantly at risk, (2) which contaminants are responsible for this risk, and ( 3) which OUs significantly contribute to risk. To address these issues, this report contains the following:

- an evaluation of the potential use of OUs by 57 endpoint species identified in Suter et al. (1994a),
- a preliminary ranking of OUs according to those that may present the greatest ecological risk,
- a preliminary assessment of risks to selected piscivorous wildlife (i.e., mink, river otter, belted kingfisher, and great blue heron),
- a preliminary assessment of risks to selected vermivorous and herbivorous wildlife (i.e., American woodcock, short-tailed shrew, white-tailed deer, and wild turkey), and
- a proposed revision schedule.

Data used in this preliminary assessment included a reservation-wide land use/land cover classification (Washington-Allen et al. 1995), reservation-wide fish bioaccumulation data from the Biological Monitoring Programs, and soil contamination data for 12 of 37 OUs. These data were derived from ORR computer databases (OREIS and BEIDMS).

Potential use of OUs by endpoint species listed in Suter et al. (1994a) was estimated by comparing habitat requirements for the endpoint species (obtained from the literature) to the nine landcover types identified in Washington-Allen et al. (1995). An OU was considered to provide habitat for an endpoint species if at least one of the habitat types required by the species was present on the OU. OUs were ranked by the number of species for which they could potentially provide habitat and endpoint species were ranked by the number of OUs on which suitable habitat was available. Conclusions of this evaluation include: 1) The largest OUs on the ORR generally have the most diverse habitat and consequently can support the greatest number of potential endpoint species; and 2) Species that can use urban habitats or have broad habitat requirements have the highest potential to experience exposure due to the large numbers of OUs that provide suitable habitat.

Risks to piscivorous wildlife were assessed using contaminant concentrations in fish from four watersheds on the ORR (i.e., Bear Creek, East Fork Poplar Creek, the K-25 vicinity, and White Oak Creek). Additional data used in this assessment included toxicity tests performed on mink, and field surveys of mink and great blue heron. Monte Carlo simulations of contaminant exposure estimates were calculated for each species by watershed. The resulting exposure distributions were then combined with literature-derived population density data for each endpoint species to estimate the number of individuals of each species likely to experience adverse effects within each watershed. These numbers were then summed for the reservation as a whole to estimate the proportion of the ORR population potentially at risk. By combining the multiple lines of evidence available to assess risks to piscivores, the following conclusions may be made:

- Cadmium in fish presents a significant risk to mink within the Bear Creek watershed and to an estimated 17.5% of the mink population on the ORR. ORR-wide risk to mink from cadmium may be underestimated due to the lack of data from the two largest watersheds (i.e., East Fork Poplar Creek and the K-25 vicinity). Combined exposure of mink to PCBs and mercury may present a hazard to mink in East Fork Poplar Creek. Risks from contaminants in other watersheds are not significant.

- Evaluation of the potential risks to a future ORR-wide population of otter indicates that cadmium in Bear Creek presents a risk to 20% of the ORR-wide population; mercury in East Fork Poplar Creek presents a risk to either 12% or 36%. Because the river otter is a state threatened species, effects to any individual is significant. Therefore, the weight of evidence suggests that Cd in Bear Creek and mercury in East Fork Poplar Creek represent significant risks to establishment of a future ORR-wide river otter population.

- Mercury in fish presents a significant risk to belted kingfisher within the East Fork Poplar Creek watershed and consequently to an estimated 37% of the kingfisher population on the ORR.

- While mercury in fish is estimated to represent a significant risk to great blue heron within the East Fork Poplar Creek watershed and consequently to an estimated 37% of the heron population on the ORR, studies on two of five colonies adjacent to the ORR indicate that reproduction at these locations is not impaired. Contaminant bioaccumulation and reproductive success are unknown at the three additional colonies adjacent to the ORR. Additionally, the primary foraging locations for herons at the two studied colonies is unknown. Because herons can travel long distances in search of food (>15 km), they are likely to forage at off-site as well as onsite locations, reducing both the exposure they receive and the risk they experience. If birds from the unstudied colonies forage more extensively on the ORR, they may experience greater risk. Due to the high risk estimated for mercury exposure on the ORR, the lack of data for three of five heron colonies adjacent to the ORR, and uncertainty as to where birds from the five ORR colonies forage, a conclusion concerning whether or not great blue heron on the ORR are at risk cannot be made.

On the ORR, while most wide-ranging wildlife species reside primarily in the uncontaminated terrestrial habitats outside of source OUs, they may also use those source OUs on which suitable habitat is present. The degree to which a source OU is used (and therefore the risk that it may present) is dependant upon the availability of suitable habitat on the OU. OUs with little or no habitat will experience little use (and will present minimal risk) while those with considerable habitat are likely to experience considerable use (and depending upon the degree of contamination, may present significant risks). While *individuals* may experience adverse effects through exposures received at source OUs, the primary concern for ecological risk assessment is for effects at the population-level To evaluate effects to the ORR-wide wildlife populations, habitat suitability and population density on the ORR and within OUs must be considered. A general, 6-step, habitat-based approach was developed that is applicable to all wildlife species on the ORR. The approach is outlined below:

1. Individual-based contaminant exposure estimates are generated for each OU using the generalized exposure model outlined in Sample and Suter (1994).

2. Contaminant exposure estimates are compared to NOAELs or LOAELs to determine the magnitude and nature of effects that may result from exposure at the OU. If the exposure estimate >LOAEL, then individuals at the OU may experience adverse effects.

3. Availability and distribution of habitat on the ORR and within each OU is determined using the ORR landcover map presented in Washington-Allen et al. (1995).

4. Habitat requirements for the endpoint species of interest are compared to the ORR habitat map to determine the area of suitable habitat on the ORR and within OUs.

5. The area of suitable habitat on the ORR and within OUs is multiplied by population density values for the selected endpoints to generate estimates of the ORR-wide population and the numbers of individuals expected to reside within each OU.

6. The number of individuals for a given endpoint species expected to be receiving exposures >LOAELs for each measured contaminant is totaled. This is performed using the OU-specific population estimate from step 5 and the results from step 2. This number is then compared with

the ORR-wide population to determine the proportion of the ORR-wide population that is receiving hazardous exposures. Using the 20% criterion outlined in Suter et al. (1994a), if the proportion of the ORR-wide population receiving hazardous exposures ≥20%, then an adverse population-level effect is assumed to be present.

Because contaminant concentrations in soil were the most readily available type of data and contaminant concentrations in plants and earthworms can be easily estimated using soil-plant or soil-worm uptake factors, vermivores and herbivores were selected as endpoint categories to demonstrate the applicability of the habitat-based approach. Conclusions of this assessment were that while there are significant risks to individuals of selected herbivore and vermivore endpoint species resident on OUs, the reservation-wide populations of these endpoints are unlikely to be significantly affected (<20% of the ORR population is affected). This conclusion must be viewed with caution, however because data were evaluated for only 12 of 37 OUs. Inclusion of additional OUs is likely to increase the proportion of the ORR populations exposed and at risk.

Finally, this preliminary assessment of risk to wide-ranging wildlife species on the ORR is based on only a small portion of the data available for the reservation. To accurately evaluate the nature and magnitude of risks on the ORR, all available data should be incorporated and considered. It is recommended that this report be revised and updated annually until all existing data have been incorporated. Following this, revisions should be produced on a five-yr schedule to incorporate new data that become available.

# 1. INTRODUCTION

More than approximately 50 years of operations, storage, and disposal of wastes generated by the three facilities on the Oak Ridge Reservation (ORR) (e.g., K-25, X-10, and Y-12), has resulted in a mosaic of uncontaminated property and lands that are contaminated to varying degrees. This contaminated property includes source areas (source operable units or OUs which are the industrial facilities themselves and the waste disposal or waste storage areas) and the terrestrial and aquatic habitats down gradient from these source areas (integrator OUs; Fig. 1.1). While the integrator OUs generally contain considerable habitat for biota, the source OUs provide little or no suitable habitat.

Historically, ecological risk assessment at CERCLA sites has focused on species that may be definitively associated with a contaminated area or source OU. This is necessary to identify areas where risk is sufficiently high to warrant remediation. Fig. 1.1 outlines a conceptual model for contaminant transfer both within and through a source OU. Endpoints considered in source OUs include plants, soil/litter invertebrates and processes, aquatic biota found in on-OU sediments and surface waters, and small herbivorous, omnivorous, and vermivorous (i.e., feeding on ground, litter, or soil invertebrates) wildlife. All of these endpoints have limited spatial distributions or home ranges such that numerous individuals or a distinct population can be expected to reside within the boundaries of the source OU. Contaminants move from the source to either surface soil, surface water, or sediments (Fig. 1.1). Aquatic biota may be exposed to contaminants through direct contact with water and sediment; small herbivores, omnivores, and vermivores may be exposed through ingestion of contaminated surface water. Contaminants in soil may be taken up by plants and soil/litter invertebrates; consequently small herbivores, omnivores, and vermivores that feed on these food types may be exposed. These small terrestrial wildlife species may also be exposed to contaminants through incidental or purposeful ingestion of soil.

Assessment of the endpoints outlined above is adequate for source OUs and for sites with single, discrete areas of contamination that only provide habitat for species with limited spatial (e.g., small home range) requirements. It is not adequate however for large sites with multiple, spatially separated contaminated areas the ORR that provide habitat for wide-ranging wildlife species. Because wide-ranging wildlife species may travel between and use multiple contaminated sites they may be exposed to and be at risk from contaminants from multiple locations. Use (and therefore exposure and risk) of a particular contaminated site by wide-ranging species will be dependant upon the amount of suitable habitat available at that site. Therefore to adequately evaluate risks to wide-ranging species at the reservation-wide scale, the use of multiple contaminated sites must be weighted by the amount of suitable habitat on OUs. Highly contaminated OUs that provide little habitat are unlikely to be significant contributors to ORR-scale risk. Conversely, moderately contaminated sites that contain considerable habitat may significantly contribute to ORR-scale risk.

In spring of 1994, a series of DQO (data quality objectives) meetings were held among the FFA (Federal Facilities Agreement) parties [i.e., U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Tennessee Department of Environment and Conservation (TDEC)] to develop an approach and plan for assessing risks to wide-ranging species that could not be adequately addressed at the source OU level. The results of these discussions are presented in the ORR ecological

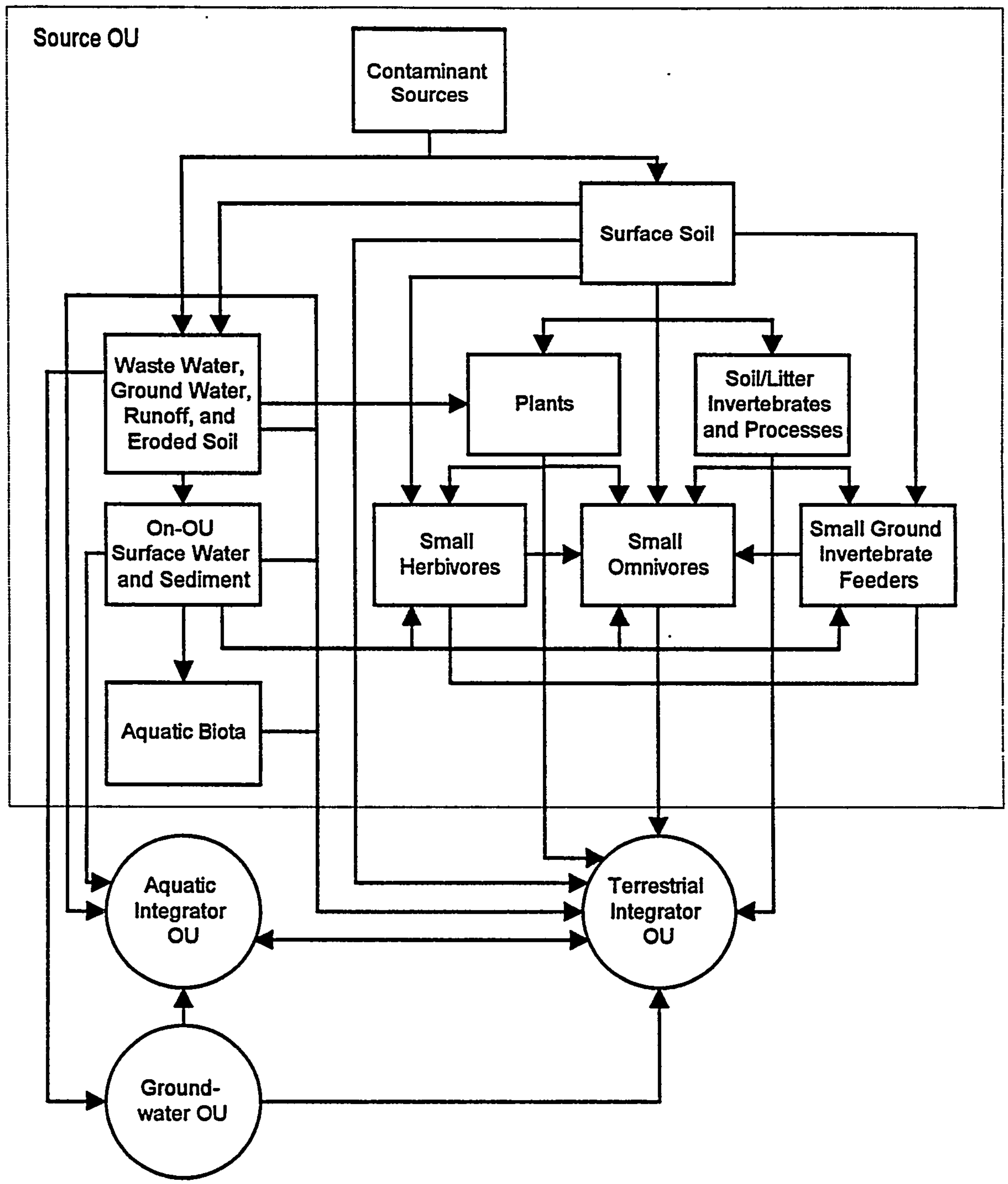


**Fig. 1.1. Conceptual model of the transfer of contaminants through a source OU and into integrator OUs.**

risk assessment strategy document (Suter et al. 1994). This report is based upon this document and presents the preliminary assessment of ecological risks to wide-ranging species from contaminants on the ORR.

The reservation-wide ecological risk assessment is intended to serve several purposes. These include: (1) identifying which endpoints are significantly at risk, (2) which contaminants are responsible for this risk, and (3) which OUs significantly contribute to risk. To address these issues, this report contains the following:

- **An evaluation of the potential use of OUs by 57 endpoint species identified in Suter et al. (1994a)**—This is to identify endpoint species that may require additional attention in future assessments and is based on a comparison of species-specific habitat requirements and the amount of suitable habitat within OUs.

- **A preliminary ranking of OUs according to those that may present the greatest ecological risk**—This is to aid in the prioritization of OUs for potential remediation and is also based on habitat in OUs and the number of species for which this habitat is suitable.

- **A preliminary assessment of risks to piscivorous wildlife**—Because contaminants accumulate in aquatic systems, if reservation-scale risks are likely, they should be most evident among piscivores.

- **A preliminary assessment of risks to vermivorous and herbivorous wildlife**—This is to demonstrate the applicability of habitat-based assessment methodology.

- **A proposed revision schedule**—Because this assessment is based on only a portion of the data available for the ORR and RIs (remedial investigations) are currently in progress for two potential significant OUs (e.g., WAG 2 and Bear Creek), periodic updates should be performed until all available data have been assembled, incorporated, and evaluated.

Detailed assessments of risk were not performed for all 57 endpoint species for which habitat availability on OUs was evaluated. Risks were evaluated only for selected piscivores, vermivores and herbivores. Selection of these three trophic groups was determined by availability of data (i.e., fish body burdens, soil contaminant concentrations, and soil-plant or soil-earthworm uptake factors). Risks to selected species from other trophic groups identified in Suter et al. (1994a; i.e., aquatic herbivores, aquatic invertebrate feeders, flying insectivores, arboreal insectivores, large omnivores, predators, and scavengers) will be assessed in future revisions of this report.

The species for which detailed risk assessments were performed include: mink, river otter, belted kingfisher, great blue heron, wild turkey, white-tailed deer, American woodcock, and short-tailed shrew. These species were selected because they are known or expected to be sensitive to contaminants that are present on the ORR (i.e., mink and otter), are representative of groups that are likely to be highly exposed (i.e., piscivores (mink, otter, kingfisher, and heron) and vermivores (woodcock and shrew)), are threatened or endangered (T&E) species or a surrogate for related T&E species (i.e., otter and shrew), or are well characterized on the ORR (site-specific data exists for mink, great blue heron, white-tailed deer, and wild turkey).

It should be emphasized that the results presented in this report are preliminary, i.e, based on only a subset of all data that exists on the ORR. The most relevant and accessible data have been selected for use at this time. As additional data are collected, made available, and incorporated, conclusions concerning the presence or magnitude of risks to wide-ranging species on the ORR may change. The quality and completeness of data used will be discussed in each chapter as it relates to the uncertainty of the risk assessment.

Assessment of ecological risks from radionuclides are not considered at this time. In human health risk assessment, the primary concern from exposure to radionuclides is increased incidence of cancer at the individual level. In ecological risk assessment, the concern is for population-level effects (except for T&E species, however). Because there is little evidence that cancer plays any significant role in wildlife populations, radionuclides were not considered at this time. Due to the importance and prevalence of radionuclide contamination on the ORR, risks associated with radionuclide exposure will be evaluated in future revisions of this report.

# 2. DATA

To identify data that would be useful for this project, a data search was initiated in which OU project managers were contacted and queried concerning the existence, status, nature, and availability of data concerning their OU. The search emphasized data concerning concentrations of contaminants in soil, water, sediment, and biota. The results of this survey are summarized in Appendix A. Briefly, while considerable data have been collected at OUs on the ORR, aside from data that currently reside in OREIS (Oak Ridge Environmental Information System) or in BEIDMS (Bechtel Environmental Information Data Management System), much data were not readily available. The lack of availability was primarily due to data being stored and maintained in multiple forms (electronic vs. hard copy; various database programs; etc.). Compilation and standardization of the voluminous data for the ORR was beyond the current scope of this project. The data availability issue is currently being addressed through the Environmental Information Management Program as part of the ORR ER program.

Three general categories of data were identified, acquired, and used for this assessment. These include an reservation-wide land use/land cover classification (Washington-Allen et al. 1995), fish bioaccumulation data from the Biological Monitoring Programs, and soil contamination data derived from ORR computer databases (OREIS and BEIDMS).

The reservation-wide land use/land cover classification is presented in Washington-Allen et al. (1995). Availability and distribution of nine land use/land cover types (Table 2.1) on the ORR was determined using satellite imagery and ground-truthing. These data were incorporated into a Geographic Information System (GIS) to produce a map of the available cover types on the ORR. OU boundaries were then overlaid on the reservation-wide cover map to produce OU-specific cover maps. Finally the area (ha) of each cover type on the ORR as a whole and within each OU was calculated.

Fish bioaccumulation data consisted of contaminant concentrations in fish and were derived from five sources. Descriptions of these data sets are presented here.

- **Name: Bear Creek OU4**
  - Spatial coverage: three locations in Bear Creek (BCK 12.4, BCK 9.4, and BCK 3.3) and one off-site location (Hinds Creek)
  - Analytes: metals and PCBs
  - Species: stone rollers
  - Principal Investigator: George Southworth.

- **Name: BMAP Bioaccumulation Task**
  - Spatial coverage: reservation-wide; 8 locations in vicinity of K-25, 2 locations in Bear Creek, 8 locations in White Oak Creek basin, 12 locations in East Fork Poplar Creek, and 3 off-site locations (Beaver Creek, Brushy Fork, and Hinds Creek)
  - Analytes: primarily mercury and PCBs
  - Species: sunfish, largemouth bass, and carp
  - Principal investigators: George Southworth and Mark Peterson.

**Table 2.1. The land use/landcover classes used in habitat classification**

| Land use/landcover | Description |
|---|---|
| Urban land | Mixture of administrative buildings, laboratories, heavy commercial and industrial buildings, lawns, and clumped shade trees |
| Deciduous forest land | Areas of hardwood forest types |
| Mixed Forest Land | Areas of a mixture of hardwoods and pine trees |
| Evergreen forest land | Areas dominated by mature pine forest type with trees generally older than 35 years (in 1994) and having an uneven canopy |
| Evergreen plantation | Areas of pine trees which are row planted, are of uniform age, and are generally younger than 35 years (in 1994) |
| Pasture land | Fields of pasture grasses, grassland, row crops, and/or shrub land cover |
| Transitional areas | Secondary early successional sites, usually grassland to grassland shrub mix; generally mowed along power line corridors |
| Barren land | Cropped fields, plowed or bare ground areas, or areas where vegetation has been removed, such as construction sites or quarries |

- **Name: Upper East Fork Poplar Creek Bioaccumulation Study**
  - Spatial coverage: three locations in Upper East Fork Poplar Creek and one off-site location (Hinds Creek)
  - Analytes: mercury, PCBs, and pesticides
  - Species: stone rollers and shiners
  - Principal investigator: Walter Hill.

- **Name: Lower East Fork Poplar Creek RI**
  Spatial coverage: 6 locations in East Fork Poplar Creek.
  Analytes: Metals, PCBs, pesticides, and other organics
  Species: sunfish, largemouth bass, and stone rollers
  Principal investigator: SAIC.

- **Name: K-901 Holding Pond**
  Spatial coverage: 1 location (K-901 pond)
  Analytes: metals, radionuclides, PCBs, pesticides, and other organics
  Species: shad, largemouth bass, and carp
  Principal investigator: SAIC.

These data were combined into one large data set. While all small fish (stonerollers, shiners, and shad) were analyzed whole, all large fish (sunfish, largemouth bass, and carp) were analyzed as fillets only. Whole-body contaminant concentrations for metals in large fish were estimated using fillet-to-whole body ratios obtained from spotted bass collected in the vicinity of the Portsmouth Gaseous Diffusion Plant (Southworth 1994). Whole-body contaminant concentrations for organics in large fish were estimated using fillet-to-whole body ratios obtained from largemouth bass and catfish collected from the Clinch River.

The last data set used in this report consists of contaminant concentrations in soil from OUs. These data were extracted from the OREIS and BEIDMS databases. The data were restricted to include only the top two feet of soil. This was assumed to include the soil horizons wildlife species were most likely to be exposed to. Data were obtained for the following OUs: Bear Creek OU1, Bear Creek OU2, Lower East Fork Poplar Creek, Upper East Fork Poplar Creek OU2, WAG 1, WAG 6, South Campus Facility, K-1407, K-1414, and K-1420. In addition, soil data from risk assessments completed at two OUs (Chestnut Ridge OU2 and WAG 5) were evaluated.

Again it should be noted that these data do not represent all available data. They simply represent a subset of the total that could be assembled, collated and prepared at this time. Additional data will be acquired and incorporated in future revisions of this report.

# 3. EVALUATION OF POTENTIAL USE OF OPERABLE UNITS ON THE OAK RIDGE RESERVATION BY WILDLIFE

One of the primary factors determining the presence or absence of wildlife species in any area is the availability of suitable habitat. If suitable habitat is available (and the wildlife species of interest are present in the area), use of a site by wildlife is likely. Conversely, if no suitable habitat is available, use of the site is unlikely. In terms of risk to wildlife on the ORR, if an OU contains habitat for wildlife, it is likely to be used, and therefore wildlife that use the site may be exposed to contaminants and potentially be at risk. By comparing the habitat requirements of wildlife endpoints to the habitats available on OUs on the ORR, OUs that *may* present risk and endpoints that *may* be at risk can be identified.

Uncertainty associated with identifying OUs or endpoints as presenting or being at risk must be emphasized because contaminant data are not used in this evaluation; it is simply based on a co-occurrence of factors that increase the *potential* for an OU to present a risk or for an endpoint to be at risk. While this evaluation can identify those species that are not at risk and OUs that do not present on-OU risk (If an OU contains no suitable habitat, use and exposure are unlikely, therefore risks are unlikely; It should be noted, however that OUs that do not contain any suitable habitat may act as sources of contamination to down gradient areas. Therefore, while there may be no on-OU risks, they may contribute significantly to off-OU risks), without incorporating OU-specific contaminant data and estimating exposure, the actual nature and magnitude of risk at an OU cannot be determined.

Information concerning the habitat requirements for the 57 endpoint species identified in Suter et al. (1994) was obtained from the literature (Table B.1). These data were then compared to the nine landcover types identified on the ORR in Washington-Allen et al. (1995) to identify landcover types on the ORR that an endpoint is likely to use (Table B.2). Habitat requirements information for endpoint species was generally far more detailed than the land cover types identified on the ORR. Consequently some assumptions and professional judgments were applied in matching habitat requirements with available habitat types. For example, many species are listed as requiring floodplain, bottom land, or riparian forest (Table B.1). This habitat type is not specifically delineated in Washington-Allen et al. (1995). Because the dominant forest habitat types at the three OUs that are located in floodplains (e.g. WAG 2, Bear Creek, and Lower East Fork Poplar Creek) are deciduous and mixed forest (Table B.3), if a species was identified as requiring floodplain forest, it was assigned to these habitats. This approach is conservative, because deciduous and mixed forests are not restricted to floodplain locations. A similar approach was used for other landcover types not specifically identified in Washington-Allen et al. (1995).

The amount of habitat (in ha) in each of the nine categories observed at each OU is summarized in Table B.3. The presence or absence of habitat for the 57 endpoint species at OUs at K-25, X-10, and Y-12 are summarized in Tables B.4, B.5, and B.6, respectively. Tables B.7 and B.8 present the total number of OUs that provide habitat for each species and the total number of species with habitat on each OU, respectively. An OU was considered to have habitat for a species if any one of the landcover categories from Tables B.2 and B.3 coincided. Professional judgement was employed in determining if the habitat at an OU was suitable for an endpoint. For example, if the species required large bodies of water, and while water was present an OU but consisted on a small stream, the habitat was considered unsuitable. Habitat was considered only on a presence/absence basis—the amount of habitat was not incorporated into the evaluation of whether or not an species would use an OU. It is recognized that this approach is overly simplistic and conservative. Use of an OU by a species will depend on the amount of habitat available (not just suitability), the connectivity of the on-OU habitat to similar habitat off the OU (isolated patches will receive less use than contiguous patches), and the amount of human activity in the vicinity (use by many species is inversely related to human activity). This evaluation was performed to determine simply if an endpoint could use an OU. A more detailed evaluation of the quality and quantity of habitat at an OU will be performed in a manner similar to that in Sect. 5 as part of a future revision of this report.

As would be expected, OUs with high diversity of landcover types (i.e., many landcover types present on the OU) were determined to be able to support the greatest number of endpoint species (Table B.8). These OUs were also the largest on the ORR (Table B.3) Small OUs located within the plant sites (i.e., UEFPC OU2 and OU3) were estimated to support the lowest number of endpoint species. If potential on-OU risk is determined simply by the number of species that might use an OU, WAG 2, K-901, LEFPC, Bear Creek, and WAGs 4, 5, 6, and 7 present the greatest risk (Table B.8). OUs that present the least risk (based solely on number of endpoints) include K-1413, K-1004, K-1401, K-1420, UEFPC OU2 and UEFPC OU 3.

Endpoint species estimated to be present at all 37 OUs are either habitat generalists (i.e., starlings, raccoons), tolerant of human activities (e.g., groundhog, American robins, Canada geese), or make use of structures (e.g., barn owl, Rafinesque's big-eared bat; Table B.7). The next most common group of endpoint species (expected to be found at 31 OUs), consists of species with broad habitat preferences. These species use both forested and open (i.e. pasture and transitional) habitats. Species that require aquatic habitat (ponds, streams, etc.) are expected at 16 OUs, while only three OUs (K-901, K-1007, and WAG 2) are suitable for those species that need large bodies of water (bald eagle, osprey, double-crested cormorant, and gray bat; Table B.7). Only three endpoint species are not expected to be present on any OUs on the ORR: golden eagles and cougars (the ORR as a whole probably does not provide sufficient suitable habitat for these species) and the Tennessee cave salamander (no caves are currently known to exist on any OU, therefore there is no habitat for this aquatic troglodytic salamander). The last endpoint, the green salamander, requires moist rock outcroppings. Locations and possible distributions of this habitat feature within OUs is unknown at this time.

## 3.1. QUALITY AND COMPLETENESS OF DATA

The completeness of data for this portion of the assessment is adequate, however, the quality of data needs improvement. While a highly significant first step, the level of detail in the ORR landcover map is far less than what is needed to accurately estimate the actual presence of suitable habitat on each OU. Incorporation of aspect and elevation data in the ORR landcover map would be useful to differentiate dry upland sites from moist bottom lands. It would also allow floodplain habitats to be delineated. Additional, more detailed data on habitat requirements (and their relative value) for each endpoint species would also increase the precision in the habitat use predictions for each OU. By combining the relative habitat preferences for each endpoint species with the amounts of each habitat type present on each OU, a better estimate of the likelihood of use (and therefore the potential for exposure and risk) may be obtained.

# 4. ASSESSMENT OF RISKS TO PISCIVORES ON THE OAK RIDGE RESERVATION

## 4.1. PROBLEM FORMULATION

This section discusses the attributes and selection of appropriate ecological endpoints, describes the ecological setting, provides information on the sources and hazards to which organisms may be exposed, and integrates this information into a conceptual model that portrays the interaction among sources and endpoints at the sites. The information provided here sets the stage for the exposure assessment section that follows.

### 4.1.1. Ecological Assessment Endpoints

The hazard identification phase of an ecological risk assessment must identify both the assessment endpoints, which are explicit statements of the characteristics of the environment that are to be protected, and the measurement endpoints, which are quantitative summaries of a measurement or series of measurements that are related to effects on an assessment endpoint.

#### 4.1.1.1 Assessment endpoints

The following assessment endpoints selected for the assessment of risks to piscivorous wildlife: toxicity to mink (*Mustela vison*), river otter (*Lutra canadensis*), belted kingfisher (*Ceryle alcyon*), and great blue heron (*Ardea herodias*) resulting in a reduction in population abundance or production. These assessment endpoints are those that have been agreed to be appropriate for the ORR by the FFA parties (Suter et al. 1994a). The criteria for selection of the entities are those recommended by the EPA (Risk Assessment Forum 1992), plus considerations of scale and practical considerations.

River otter are listed as a threatened species by the TWRA (Tennessee Wildlife Resources Agency). While this species is not known to occur on the ORR at the present time, they have been included in this assessment because the ORR contains suitable habitat, a reintroduction program is underway in east Tennessee, and they may become established on the ORR in the future. To determine if the ORR could support this threatened species, it is important to evaluate the nature and magnitude of risk that contaminants on the ORR may present to otter.

The appropriate properties of the entities selected by these criteria depend on the level of organization of the entity and the criteria that led to their selection. **Organism level**—In general, protection of individual organisms is appropriate only for threatened and endangered species. Only one of the selected species, river otter, is a T&E species; therefore organism-level properties were used for this assessment endpoint. **Population level**—The appropriate endpoint properties for populations of endpoint species are abundance and production.

Finally, the level of effects on these properties of the endpoint entities that is considered to be potentially significant is 20% as agreed by the FFA parties (Suter et al. 1994a). This level is consistent with current regulatory practice.

Assessment of piscivores is a logical first step to evaluate reservation-wide risks. Contaminants present on the ORR are known to accumulate readily in aquatic foodwebs (i.e., mercury and PCBs).

Some piscivores (mink in particular) are known to be sensitive to mercury and PCBs. The diet of piscivores frequently consists exclusively of fish or other aquatic prey, therefore members of this group are likely to be highly exposed. Finally, most piscivores are highly mobile, they therefore may be exposed to contaminants from multiple locations.

The ORR was partitioned into four watersheds: Bear Creek, Fork Poplar Creek, the K-25 area (consisting of the K-25 ponds, Mitchell Branch, and Poplar Creek adjacent to the K-25 plant), and White Oak Creek. Risks were evaluated within each watershed and these results were used to determine risks to piscivores across the ORR as a whole. For comparison, risks were evaluated in three nearby, off-site streams (Beaver Creek, Brushy Fork, and Hinds Creek).

#### 4.1.1.2 Measurement endpoints

Three basic types of effects data are potentially available to serve as measurement endpoints: results of biological surveys, toxicity tests performed using fish from the ORR, and literature derived toxicity test results for chemicals found on the ORR. Following are measurement endpoints for each assessment endpoint:

- **Mink**
  - Biological survey data—Limited data concerning presence/absence, movements, and bioaccumulation of contaminants are available for mink on the ORR.
  - Media toxicity data—Results of reproductive toxicity tests are available for ranch mink fed fish obtained for the Poplar Creek embayment.
  - Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in mammals with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **River otter**
  - Biological survey data—None.
  - Media toxicity data—Results of reproductive toxicity tests are available for ranch mink fed fish obtained for the Poplar Creek embayment. Because both mink and otter are mustelids, the test endpoints for mink are assumed to correspond to the assessment endpoint (otter) after allometric scaling.
  - Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in mammals with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **Belted kingfisher**
  - Biological survey data—None.
  - Media toxicity data—None.
  - Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in birds with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **Great blue heron**
  - — Biological survey data—Field data concerning contaminant bioaccumulation and reproductive success were available for four heron rookeries near the ORR.
  - — Media toxicity data—None.
  - — Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in birds with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

### 4.1.2. Ecological Conceptual Model

The ecological conceptual model graphically represents the relationships between the contaminant sources and the endpoint receptors. It integrates the information in the other subsections of the hazard identification and presents them graphically. It is not intended to show all of the possible sources, routes of transport, modes of exposure, or effects. Rather, it includes the only identified CERCLA source, the receptors that are designated as assessment endpoint species or communities, and the major routes that result in exposure to contaminants from the ORR.

The conceptual model for exposure of piscivores to contaminants is presented in Fig. 4.1. Components of this model include aquatic biota (aquatic plants, invertebrates, fish, and amphibians) that reside in ponds and streams on the ORR and the piscivorous wildlife that feeds on aquatic biota. The aquatic biota are exposed to contaminants from surface water and sediments. Contaminants are bioaccumulated in lower trophic levels (i.e., plants or invertebrates) and transferred to higher trophic levels (i.e., invertebrates, fish, or amphibians). Piscivorous wildlife consume fish, amphibians, and invertebrates and are therefore exposed to accumulated contaminants (Fig. 4.1).

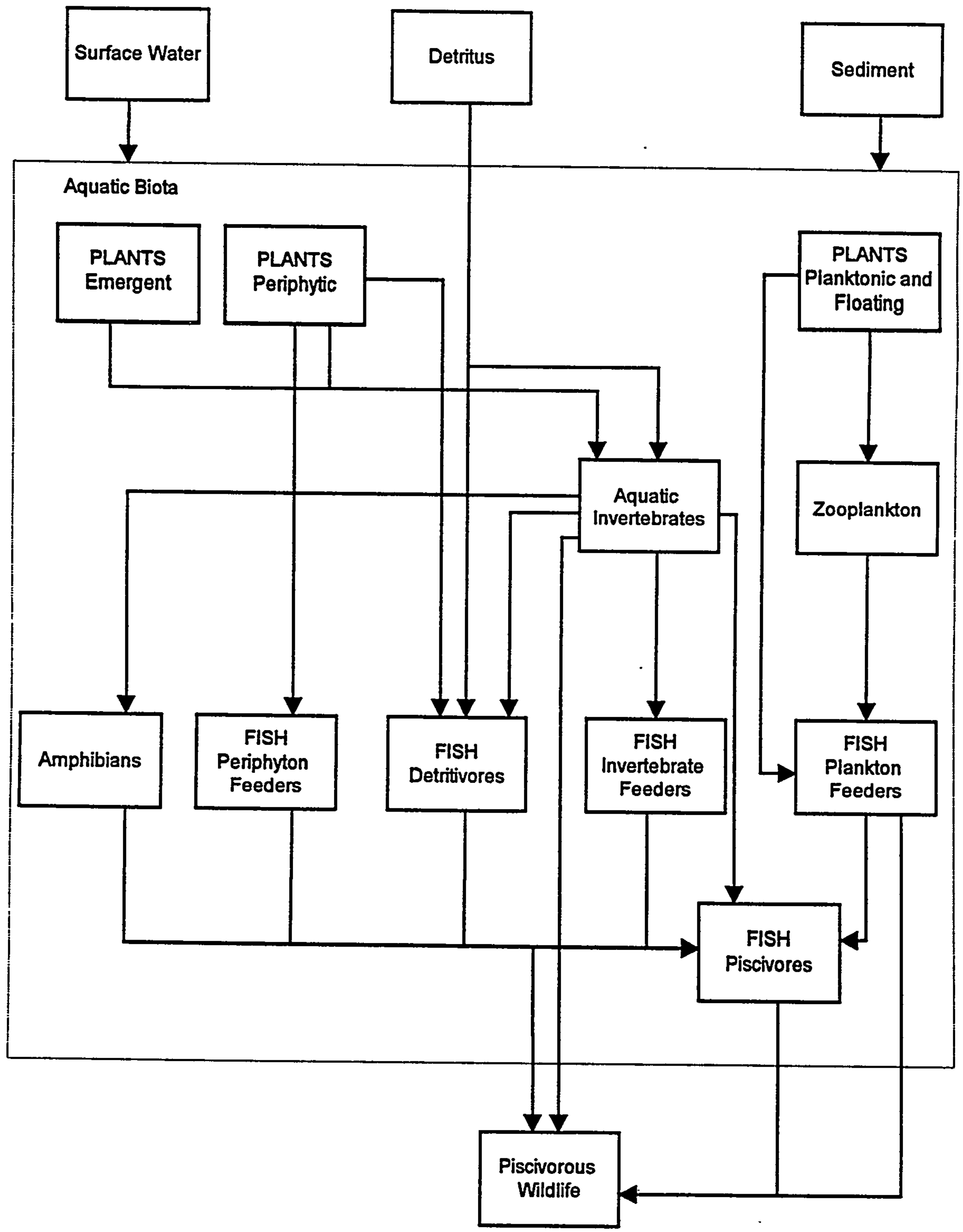


**Fig. 4.1. Conceptual model for the exposure of piscivorous wildlife to contaminants.**

## 4.2 EXPOSURE ASSESSMENT

Piscivorous wildlife may be exposed to contaminants through ingestion of contaminated media (fish, other aquatic prey, and water) and through contaminants accumulated in the tissues of the piscivore itself. In this assessment, ingestion of food was the only pathway considered. Exposure through ingestion of water will be included in a future revision. Contaminant exposure through ingestion was estimated for mink, otter, belted kingfisher, and great blue heron Exposure estimates were calculated for 41 locations on the ORR: five locations in Bear Creek, 20 locations in East Fork Poplar Creek, 8 locations in the vicinity of the K-25 plant, and 8 locations in the White Oak Creek basin. For comparison, contaminant exposure was also estimated for three off-site locations. Exposure through contaminants accumulated in tissues was measured for nestling great blue herons. Locations of sampling locations within Bear Creek, East Fork Poplar Creek, K-25, White Oak Creek, and the off-site locations are presented in Figs. C.1 through C.5.

### 4.2.1 Exposure Through Oral Ingestion of Fish

For exposure estimates to be useful in the assessment of risk to wildlife, they must be expressed in terms of a body weight-normalized daily dose or mg contaminant per kg body weight per day (mg/kg/d). Exposure estimates expressed in this manner may then be compared with toxicological benchmarks for wildlife, such as those derived by Opresko et al. (1994), or to doses reported in the toxicological literature. Estimation of the daily contaminant dose an individual may receive from a particular medium for a particular contaminant may be calculated using the following equation:

$$E_j = \sum_{i=1}^{m} \left( \frac{IR_i \ x \ C_{ij}}{BW} \right) \qquad (1)$$

where:

$E_j$ = total exposure to contaminant (j) (mg/kg/d)
m = total number of ingested media (e.g., food, water, or soil)
$IR_i$ = consumption rate for medium (I) (kg/d or L/d)
$C_{ij}$ = concentration of contaminant (j) in medium (I) (mg/kg or mg/L)
BW = body weight of endpoint species (kg).

Exposure estimates were calculated for all contaminants detected at all ORR sampling locations. Because wildlife are mobile, their exposure is best represented by the mean contaminant concentration in media. To be conservative, the 95% upper confidence limit (UCL) is used in exposure estimates. To prevent bias that may result from calculating 95% UCLs using data that contains values below the detection limit, product limit estimator (PLE) was used to calculate the 95% UCLs for contaminants observed in fish and water These data were used in the initial exposure estimates. Exposure estimates for contaminants that may potentially present a risk to piscivorous wildlife (based upon comparisons to NOAELs and LOAELs) were recalculated using Monte Carlo simulations. (**Note: Because the purpose of the initial exposure estimate is to be conservative and to identify COPECs, the 95% UCL was used regardless of whether or not the value exceeded the maximum observed value. Overestimates of exposure that may occur at the screening level are addressed through the use of Monte Carlo simulation.)**

#### 4.2.1.1 Fillet-to-whole fish ratios

Fish data from the ORR consisted of analyses of both whole body concentrations (generally in stonerollers, shiners, and shad) and concentrations in fillets (in sunfish, largemouth bass, and carp). Because piscivores consume whole fish (not fillets) and fillet concentrations do not accurately represent whole body concentrations, contaminant-specific fillet-to-whole fish ratios were calculated to estimate the whole-body contaminant concentration in fish for which only fillet analyses were performed. For organic chemicals, the ratios were developed using data from 15 largemouth bass and 10 channel catfish collected from the Clinch River for which both fillet and carcass (whole-body minus fillet) analyses were performed. Whole fish contaminant concentrations were determined by calculating the weighted average of the fillet and carcass contaminant concentrations (weighted by the proportion of the total fish weight represented by the carcass and fillet weights, respectively). The contaminant concentration in the whole fish was then divided by the fillet concentration to produce the fillet-to-whole fish ratio (Table C.5). Both bass and catfish were pooled to produce one ratio for each contaminant. Ratios were not available for all contaminants detected in fish from the ORR. Ratios for these contaminants were approximated using ratios for related contaminants. The ratios for inorganic contaminants were obtained from spotted bass collected in the vicinity of the Portsmouth Gaseous Diffusion Plant (Southworth 1994). Mean ratio values were used to generate all whole-fish contaminant concentration estimates.

#### 4.2.1.2 Contaminant concentrations in fish

Contaminant concentrations in fish are needed to estimate exposure. The 95% UCLs (calculated using the PLE) for contaminants detected in fish from the ORR are presented in Table C.6. Contaminants detected in fish from the background locations are presented in Table C.7. Note that data were aggregated into two size classes: <30 cm and >30 cm in length. This is because piscivore species forage on different size fish and contaminant body burdens are related to size (larger, older fish generally have higher contaminant concentrations). While mink, belted kingfisher, and great blue heron generally consume fish <30 cm in size, otter forage equally on small and large fish (see Tables C.1 to C.4). To more accurately reflect exposure, data were segregated according to size and exposure was estimated using data from the size of fish most likely to be consumed by that endpoint species. Because it was assumed that piscivores would select fish according to size and not by species all species were pooled within each size class.

While data concerning fish size were included in the BMAP, Bear Creek OU4, and Upper East Fork Poplar Creek data sets, fish sizes were not included in the Lower East Fork Poplar Creek RI or K-901 data sets. Based upon the size data in the first three data sets, all sunfish, stonerollers and shad were assumed to be <30 cm in size and largemouth bass and carp were assumed to be >30 cm for both the Lower East Fork Poplar Creek RI or K-901 data sets.

#### 4.2.1.3 Exposure modeling using point-estimates

Initial estimates of exposure of piscivorous wildlife to contaminants were performed for each sampling point using point estimates of parameters in the exposure model (Equation 1). Species-specific parameters necessary to estimate exposure using the Equation 1 are listed in Tables C.1–C.4.

To estimate contaminant exposure experienced by mink, the following assumptions were made:

- Body weight = 1 kg.
- Food consumption = 0.137 kg/d (fresh weight).
- Diet consists 54.6% of fish or other aquatic prey.
- Contaminant concentration in fish is representative of that in other aquatic prey.
- Fish sizes consumed = 100% <30 cm.
- All non-aquatic prey consumed are uncontaminated.

To estimate contaminant exposure experienced by otter, the following assumptions were made:

- Body weight = 8 kg.
- Food consumption = 0.9 kg/d (fresh weight).
- Diet consists 100% of fish or other aquatic prey.
- Contaminant concentration in fish is representative of that in other aquatic prey.
- Fish sizes consumed = 50% <30 cm and 50% >30 cm.

To estimate contaminant exposure experienced by kingfisher, the following assumptions were made:

- Body weight = 0.148 kg.
- Food consumption = 0.75 kg/d (fresh weight).
- Diet consists 100% of fish.
- Fish sizes consumed = 100% <30 cm.

To estimate contaminant exposure experienced by great blue heron, the following assumptions were made:

- Body weight = 2.39 kg.
- Food consumption = 0.42 kg/d (fresh weight).
- Diet consists 100% of fish or other aquatic prey.
- Contaminant concentration in fish is representative of that in other aquatic prey.
- Fish sizes consumed = 100% <30 cm.

Using Equation 1 and the assumptions and data described above, exposure to contaminants was estimated for mink (Tables C.8 and C.9), otter (Tables C.10 and C.11), kingfisher (Tables C.12 and C.13), and great blue heron (Tables C.14 and C.15) for each location on the ORR. Exposure estimates for all analytes detected in fish samples at the off-site locations are presented in Table C.16.

#### 4.2.1.4 Exposure modeling using Monte Carlo simulations

Employing point estimates for the input parameters in the exposure model does not take into account the variation and uncertainty associated with the parameters and therefore may over or under estimate the contaminant exposure that endpoints may receive in any given reach. In addition, calculating the model using point estimates produces a point estimate of exposure. This estimate provides no information concerning the distribution of exposures or the likelihood that individuals within a watershed will actually experience potentially hazardous exposures. To incorporate the variation in exposure parameters and to provide a better estimate of the potential exposure experienced by piscivores on the ORR, the exposure model was re-calculated using Monte Carlo simulations.

Monte Carlo simulation is a resampling technique frequently used in uncertainty analysis in risk assessment (Hammonds et al. 1994). In practice, distributions are assigned to input parameters in a model and the model is recalculated many times to produce a distribution of output parameters (e.g., estimates of contaminant exposure). Each time the model is recalculated, a value is selected from within the distribution assigned for each input parameter. As a result, distribution of exposure estimates is produced that reflects the variability of the input parameters. To determine which input parameters most strongly influence the final exposure estimate, a sensitivity analysis is performed (Hammonds et al. 1994). Detailed discussions of sensitivity and uncertainty analysis, and the use of Monte Carlo simulations in risk assessment are provided by Hammonds et al. (1994).

Monte Carlo simulations were performed on the mean exposure (mean of all sampling locations) for each watershed. The percentiles of the resulting exposure distributions represent the likelihood that an individual piscivore within a watershed will experience a given exposure level. It was also assumed that each sampling location contributed equally to the overall mean exposure (i.e., individuals within each watershed do not preferentially forage at any one location within the watershed). Watershed-wide simulations were performed for mercury and PCBs because these contaminants are among the most important on the ORR and data for these contaminants were available at all sampling locations. Additional Monte Carlo simulations were performed for contaminants where comparison of point exposure estimates to LOAELs produced HQs≥1 (LOAELs are presented in Sect. 4.3.1.; screening of exposure estimates against LOAELs is presented in Sect. 4.4.1.)

Distributions were used for the following parameters in the exposure model: endpoint body weight, average contaminant concentrations in fish, and the proportion of aquatic prey in mink diet. All distributions were assumed to be normal, except otter body weight which was assigned a triangular distribution (while a standard deviation was not available, a range was). Because these wildlife are mobile, the contaminant concentration they are exposed to on a daily basis is best represented by the average concentration instead of the entire distribution. The standard error of the mean was used to describe variation in the average contaminant concentration. All other distributions employed the calculated standard deviation of the observed data. Piscivore body weight distributions and values are listed in the following table:

| Endpoint | Distribution | Mean (kg) | Standard deviation | Range | Source |
|---|---|---|---|---|---|
| Mink | normal | 0.974 | 0.202 | | EPA 1993c |
| River otter | triangular | 8 | | 5.84–10.4 | EPA 1993c |
| Belted kingfisher | normal | 0.148 | 0.0208 | | Dunning 1984 |
| Great blue heron | normal | 2.204 | 0.337 | | Dunning 1984 |

The proportion of aquatic prey in the diets of otter, kingfisher, and herons were assumed to be 100%. No data suggest that non-aquatic prey constitute a significant portion of their diet (see endpoint discussion, above). In contrast, mink have a very variable diet. Aquatic prey (fish, amphibians, crayfish, etc.) may make up from 16% to 92%. Nine observations from five studies indicate the proportion of aquatic prey to be 0.546±0.21 (mean ± standard deviation; Table C.1). Mean and standard errors for contaminants in fish are presented in Table C.6.

Monte Carlo simulations were performed using the @Risk software. Samples from each distribution were selected using Latin hypercube sampling. The number of iterations, or recalculations, of each exposure simulation was determined by the convergence criteria set in the software. Under these criteria, iterations are performed until the between-iteration percent change in the percentiles, mean, and standard deviation are below 1.5% (i.e., the percentile, mean, and standard deviation for the latest iteration is less than 1.5% different than the those from the previous iteration). Using this convergence criteria, from 600 to 1000 model iterations were performed for each exposure estimate. Monte Carlo estimates of contaminant exposures are presented in Table C.17.

### 4.2.2 Internal Exposure of Great Blue Herons to Contaminants

To determine if contaminants from the ORR are being bioaccumulated by piscivorous wildlife, great blue heron eggs and chicks were collected from two colonies located within 3 km of the ORR and two colonies located >10 km from the site (Halbrook, unpubl. data; see Appendix F). Analyses were performed to determine the concentrations of arsenic, chromium, mercury, and PCBs in eggs, and feathers, liver, fat, and muscle of chicks. Elevated levels of Cr, Hg, and PCBs were observed in eggs from the ORR colonies (Tables F.2 and F.4, Appendix F). Hg concentrations in feathers and liver (Table D.3, Appendix D) and PCB concentrations in fat (Table F.5, Appendix F), liver (Table F.6, Appendix F), and muscle (Table F.7, Appendix F) were significantly elevated in samples from the ORR as compared to data from the off-site locations. A detailed discussion of these data are presented in Appendix F.

## 4.3 EFFECTS ASSESSMENT FOR PISCIVOROUS WILDLIFE

### 4.3.1 Single Chemical Toxicity Data

In cases where a NOAEL for a specific chemical was not available, but a Lowest Observed Adverse Effects Level (LOAEL) had been determined experimentally or where the NOAEL was from a subchronic study, the chronic NOAEL was estimated. EPA (1993d) suggests the use of uncertainty factors of 1 to 10 for subchronic to chronic NOAEL and LOAEL to NOAEL estimation. Because no data were available to suggest the use of lower values, uncertainty factors of 10 were used in all instances in which they were required.

Smaller animals have higher metabolic rates and are usually more resistant to toxic chemicals because of more rapid rates of detoxification. It has been shown that metabolism is proportional to body surface area which, for lack of direct measurements, can be expressed in terms of body weight (bw) raised to the 2/3 power ($bw^{2/3}$) (EPA, 1980a). If the dose (d) itself has been calculated in terms of unit body weight (i.e., mg/kg), then the dose per unit body surface area (D) equates to:

$$D = \frac{d \ x \ bw}{bw^{2/3}} = d \ x \ bw^{1/3} \tag{2}$$

The assumption is that the effective dose per body surface area for species "a" and "b" would be equivalent. Therefore, knowing the body weights of two species and the dose ($d_b$) producing a given effect in species "b," the dose ($d_a$) producing the same effect in species "a" can be determined:. Using this approach, if a NOAEL was available for the test species ($NOAEL_t$), the equivalent NOAEL for a wildlife species ($NOAEL_w$) was calculated by using the adjustment factor for differences in body size:

$$NOAEL_w = NOAEL_t \left( \frac{bw_t}{bw_w} \right)^{1/3} \tag{3}$$

This methodology is equivalent to that the EPA uses in their carcinogenicity assessments and Reportable Quantity documents for adjusting from animal data to an equivalent human dose.

NOAEL's and LOAEL's were derived for mink, river otter, belted kingfisher, and great blue heron. Mammalian and avian NOAEL's and experimental information used to estimate wildlife NOAEL's and LOAEL's (e.g., test species, test endpoints, citation) are listed in Tables C.18 and C.19.

Ecotoxicological profiles of the effects of Cd, Cr, Hg, Se, DDT, and PCBs to wildlife are presented in Appendix D.

### 4.3.2 Effects of Contaminants on the Reproductive Performance of Mink

Halbrook (unpubl. data; see Appendix E) conducted at Michigan State University Experimental Fur Farm, evaluated bioaccumulation of contaminants and reproductive effects in mink fed fish collected from Poplar Creek, the Clinch River (upstream of Melton Hill Dam) and the ocean. Mink were fed five diets consisting of 75% fish and 25% commercial mink diet. The diet composition and contaminant concentrations for each diet are described in the following table:

| | | Contaminant concentration (mg/kg) | |
|---|---|---|---|
| Diet | Fish composition | Mercury | PCB 1260 |
| A | 75% ocean | 0.02 ± 0.00 | 0.169 ± 0.002 |
| B | 75% Clinch River | 0.05 ± 0.00 | 11.44 ± 0.327 |
| C | 25% Poplar Creek<br>50% ocean | 0.09 ± 0.00 | 4.69 ± 0.174 |
| D | 50% Poplar Creek<br>25% ocean | 0.15 ± 0.01 | 10.41 ± 0.250 |
| E | 75% Poplar Creek | 0.22 ± 0.01 | 20.67 ± 0.458 |

Twenty-three PCB congeners were also present in varying amounts. Concentrations of most congeners increased progressively from diets A through E (Table E.5, Appendix E).

Ten mink (eight females and two males) were fed each diet for ~7 months (3 months before breeding—6 weeks postpartum). Reproductive indices measured included: number of females mated; number of females whelping; length of gestation; number of kits whelped (alive, dead); kit sex ratio; average kit body weight at birth, 3, and 6 weeks of age; and kit survival to 3 to 6 weeks of age. At 6 weeks of age, 3 kits from dietary groups A, B, C, and E were euthanized, organs (liver, spleen, and kidneys) were weighed, and tissue samples (liver, kidney, and remaining carcass) were analyzed for contaminant accumulation. (note: kits from diet D were not sampled). At the termination of the study, all adult mink were necropsied. Organs (brain, liver, kidneys, heart, lungs, gonads, and adrenal glands) were weighed and examined for histopathologies. Adipose tissue, liver, kidney, and hair were analyzed for contaminant accumulation. Liver tissue also was analyzed for ethoxyresorufin-o-deethylase (EROD) activity.

The bioaccumulation of mercury in liver, kidney, and hair (Table E.3; Appendix E), and Aroclor 1260 (and other PCB congeners) in liver and fat (Tables E.6 and E.7, Appendix E) substantially increased in adult female mink from groups fed diet A up to diet E. Mink offspring also bioaccumulated mercury in kidney tissue and carcasses and many other PCB congeners in the liver and carcasses (Tables E.8 and E.9; Appendix E), increasing progressively from mink fed diets A through E. The lowest levels were observed for mink fed diet A and increased to a maximum observed among mink fed diet E.

Significant effects were observed only among mink fed diet E; no adverse effects were observed for any other diet. Adverse effects from diet E included: weight reduction in adult mink and their offspring, reduction in litter size, and increase in liver EROD activity in adult females. Weight reduction was observed at the end of the experimental period, increasing magnitude from diet groups A to E. At the end of the experiment, the mean whole body weights of female mink in diet group E were significantly less ($p = 0.03$) than mean weights of females in diet group A (percent reduction = 20%). Mean female relative organ weights (organ weights/body weight) were not significantly different among diet groups. At 6 weeks of age, mean whole body weights were also significantly lower ($p = 0.004$) in male kits from diet group E compared to those from diet group A (percent reduction = 17%). Similar trends were observed for female kits, although differences were not statistically significant. No histological lesions were attributed to any diet. Mean litter size was significantly reduced ($p = 0.01$) in diet group E compared to diet groups A, B, and C (percent reduction relative to diet A = 38%); but not diet group D. Liver EROD activity was significantly increased in adult female mink from diet groups D and E compared with those from diet group A.

### 4.3.3 Biological Surveys

#### 4.3.3.1 Great blue heron reproduction survey

To determine if contaminants from the ORR are adversely affecting great blue heron, Halbrook (unpubl. data; see Appendix F) monitored the reproductive success at two heron colonies located adjacent to the ORR and two colonies located >10 km from the reservation. Data were collected from each nest colony between 1992 and 1994. The mean number of eggs/nest, number of chicks/nest, egg weight, and eggshell thickness did not differ between colonies within 3 km of the ORR and those >10 km away (Table F.8; Appendix F). A detailed discussion of these data are presented in Appendix F.

#### 4.3.3.2 Mink survey

Stevens (1995) investigated bioaccumulation of mercury in mink on the ORR in 1993 through 1995. The methods used in the mink survey, while indicating that mink are present on the reservation, cannot be used to estimate abundance or density on mink on the ORR. A total of four male mink were live-trapped over the course of 6073 trapnights (trapnight = 1 trap set for 24 h). One juvenile was captured along East Fork Poplar Creek, two adults were captured along Bear Creek, and one adult was captured along White Oak Creek. Captured mink were fitted with an intraperitoneal radio transmitter (to monitor movements and home range) and released. Prior to release samples of hair was collected and metals analysis. An additional 8 roadkill mink (5 male and 3 female) were collected from the ORR and surrounding areas of Roane and Anderson counties. While one roadkill sample (a male) was collected on a bridge over Bear Creek and was assumed to be a resident of Bear Creek, all others were collected off the ORR and were used as references.

The Results of metals analysis are presented in the following table:

**Metal concentrations in hair of mink from the ORR and from off-site reference samples[a]**

| Site | N | Hg | Se | As | Cd | Pb |
|---|---|---|---|---|---|---|
| East Fork Poplar Creek | 1 | 104 | 0.69 | ND[b] | ND | 0.33 |
| Bear Creek | 3 | 10.97 ± 3.42 | 1.88 ± .1.41 | 0.15 ± 0.09 | 0.04 ± .0.02 | 0.97 ± 1.28 |
| White Oak Creek | 1 | 8.8 | 1 | ND | ND | 0.37 |
| Off site | 7 | 5.15 ± 3.43 | 1.11 ± 0.25 | 0.22 ± 0.31 | 0.04 ± 0.02 | 0.7 ± 0.31 |

[a]Mean ± standard deviation mg/kg dry weight.
[b]ND = Not detected.

Radiotelemetry data on home ranges and movements were obtained for 3 mink - one each from the East Fork Poplar Creek, Bear Creek, and White Oak Creek watersheds. Mean (± standard deviation) home range for these three individuals was found to be 7.5 ± 3 km of stream. The entire home range of the East Fork Poplar Creek mink was in a highly urbanized area; it included all of upper East Fork inside the Y-12 plant and all areas of East Fork upstream of the Oak Ridge Turnpike-Illinois Avenue intersection. The home range of the White Oak Creek mink included all of White Oak Creek from the headwater tributaries to the Clinch River, including the X-10 facility. This individual was observed to use dens within the X-10 facility and moved through the facility on several occasions.

## 4.4. RISK CHARACTERIZATION FOR PISCIVOROUS WILDLIFE

Risk Characterization integrates the results of the exposure assessment (Sect. 4.2) and effects assessment (Sect. 4.3) to estimate risks (the likelihood of effects given the exposure) based on each line of evidence, and then applies a weight of evidence inference logic to determine the best estimate of risk to each assessment endpoint. In an ideal risk assessment there are three lines of evidence: literature-derived single chemical toxicity data (which indicate the toxic effects of the concentrations measured in site media), biological surveys of the affected system (these indicate the actual state of the receiving environment), and toxicity tests with ambient media (these indicate the toxic effects of the concentrations measured in site media). While three lines of evidence are available to assess risks to piscivorous wildlife, all are not available for each endpoint or for all watersheds on the ORR. Single chemical toxicity data are available for all four endpoints within all four watersheds. Toxicity tests and a field survey/bioaccumulation study were performed for mink along Poplar Creek and in the Bear Creek, East Fork Poplar Creek, and White Oak Creek watersheds, respectively. Lastly, a field survey/bioaccumulation study was performed for great blue heron along Poplar Creek and Melton Hill Lake.

Procedurally, the risk characterization is performed for each assessment endpoint by (1) screening all measured contaminants against toxicological benchmarks and background concentrations (if available), ( 2) estimating the effects of the contaminants retained by the screening analysis, (3) estimating the toxicity of the ambient media based on the media toxicity test results, (4) estimating the effects of exposure on the endpoint biota based on the results of the biological survey data, (5) logically integrating the lines of evidence to characterize risks to the endpoint, and (6) listing and discussing the uncertainties in the assessment. A detailed discussion of methods and the approach to risk characterization on the ORR is presented in Suter et al. (1994a).

### 4.4.1 Single Chemical Toxicity Data

Exposure estimates generated by the exposure model (see Sect. 4.2.1.) produced by both point estimates of parameter values and Monte Carlo simulation represent exposure at the individual level. The exposure estimates using point estimates of parameter values at each individual sampling point are used to identify COPECs and locations that contribute significantly to risk. In contrast, the watershed-level exposure distributions generated by Monte Carlo simulation represent the likelihood that an individual within the area for which exposure is modeled will experience a particular exposure.

Two types of single chemical toxicity data are available with which to evaluate piscivore contaminant exposure: NOAELs and LOAELs. NOAEL's are used to screen exposure estimates generated from point-estimates of exposure parameters; if the estimate is greater than the NOAEL, adverse effects are possible and additional evaluation is necessary (i.e., exposure modeling using Monte Carlo simulation). LOAELs are compared to the exposure distribution generated by the Monte Carlo simulation. If the LOAEL is lower than the 80th percentile of the exposure distribution, there is a >20% likelihood that individuals within the modeled location are experiencing contaminant exposures that are likely to produce adverse effects. By combining literature-derived population density data with the likelihood or probability of exceeding the LOAEL, population-level impacts may be estimated.

#### 4.4.1.1 Screening point estimates of exposure

To determine if the contaminant exposures experienced by mink, river otter, belted kingfisher, and great blue heron on the ORR are potentially hazardous, the dietary contaminant exposure estimates (generated using point estimates of parameter values; Tables C.8 through C.16) were compared to estimated NOAELs and LOAELs for these species (Tables C.18 and C.19). To quantify the magnitude of hazard, a hazard quotient (HQ) was calculated where: HQ = exposure/NOAEL or LOAEL. Hazard quotients greater than 1 indicate that individuals may be experiencing exposures that are in excess of NOAELs or LOAELs. While exceeding the NOAEL suggests that adverse effects are possible, exceeding the LOAEL suggests that adverse effects are likely. Hazard quotients for mink, river otter, belted kingfisher, and great blue heron on the ORR are presented along with the point estimates of exposure in Tables C.8 through C.16. It should be noted that because few data are available for specific PCB (Aroclor) mixtures, all PCBs were summed and the total was compared to Aroclor-1254 toxicity data.

A summary of the analytes and number of locations within each watershed where HQs>1 were observed is presented in Table C.20. The number of analytes where HQs>1 were observed is partially an artifact of the data. More contaminants appear in Bear Creek and East Fork Poplar Creek because the fish from these locations were analyzed for more contaminants. Mercury and PCBs were the contaminants that most frequently exceeded both NOAELs and LOAELs. Cadmium and Selenium exceeded both NOAELs and LOAELs for mink and otter in Bear Creek (Table C.20). DDT and chromium exceeded both NOAELs and LOAELs for both kingfisher and heron in East Fork Poplar Creek and the K-25 area , respectively (Table C.20). In White Oak Creek, while exposure at most locations exceeded NOAELs, LOAELs were infrequently exceeded; no LOAELs were exceeded for mink and PCB exposure exceeded the LOAEL for otter at only one location. Mercury exposure exceeded the LOAEL for kingfisher and heron at only one location (Table C.20).

The spatial distribution of contamination and potential risks to piscivores in Bear Creek, East Fork Poplar Creek, K-25, and White Oak Creek are illustrated in Figs. C.6, C.7, C.8, and C.9, respectively. These figures display the sum of the NOAEL-based HQs (e.g., sum of toxic units or ΣTUs) for total PCBs and mercury. Because additional data were available, arsenic, cadmium, and selenium were included for Bear Creek. Importance of contaminants was determined based upon the magnitude of the HQ. Sampling locations were arranged upstream to downstream; side tributaries are included in the order in which they enter the main stream.

In Bear Creek, cumulative risks to mink and otter decreases with increasing distance from the Y-12 plant (Figs. C.6a and C.6b). The contaminant accounting for the majority of risk to mink and otter in Bear Creek is cadmium. Among kingfisher and heron, while mercury and PCBs present the greatest hazard, no clear spatial pattern of risk is evident; cumulative risk is greatest at BCK (Bear Creek Kilometer) 4.5 and 0.6, respectively (Figs. C.6c and C.6d). This lack of a distinct pattern is likely a result of differences in data from each location and not related to a source. While data from BCK 12.4, 9.4, and 3.3 consisted of bodyburdens in stonerollers (a grazing species), data from BCK 4.5 and 0.6 consisted of bodyburdens in rock bass and red-breast sunfish (both invertebrate feeders). Mercury bodyburdens were substantially higher at BCK 4.5 and 0.6 (rock bass and red-breast sunfish) than at BCK 12.4, 9.4, and 3.3 (stonerollers; see Table C.6). The differences in bodyburdens are likely related to food habits of the fish and species-specific mercury uptake kinetics and not to a particular contaminant source.

In East Fork Poplar Creek, the pattern of cumulative risk is similar for all endpoint species; except for peaks represented by the EFPC RI sampling locations (presented as numbers in parentheses), hazard declines with increasing distance from the Y-12 plant (Fig. C.7 a–d). As would be expected, mercury accounts for the majority of risk; however, PCBs contribute approximately 50% of risk to mink and otter in upper East Fork Poplar Creek (EFK 24.8-23.4; Figs. C.7a and C.7b). It is unclear why exposure estimated with the EFPC RI data should be higher than that from the BMAP data. The time frames are comparable for both sets of data (BMAP = 1982-1993; EFPC RI = 1991); species included are comparable (BMAP = sunfish, largemouth bass, and carp; EFPC RI = sunfish, largemouth bass, and stonerollers); and no sources are known where the peaks occur (along Illinois Avenue in the City of Oak Ridge). One possible explanation for the peaks may be differences in analytical methods employed between the two data sets.

At K-25, the pattern of cumulative risk was similar for mink (Fig. C.8a), kingfisher (Fig. C.8c), and herons (C-8d); in Poplar Creek, mercury accounted for most risk while PCBs were the primary risk agent in Mitchell Branch (MIK 0.2) and at the K-901 pond. For otter (Fig. C.8b), PCBs presented the greatest risk, with the highest risks observed at the K-25 ponds (most at K-1007, least at K-710). The peaks in mercury risk observed for all species occurred at PCK 8.2 and 6.9, are most likely attributable to the input of mercury from East Fork Poplar Creek. The difference between the pattern of cumulative risk for otter and that for other piscivores can be attributed to dietary differences and variation in contaminant concentration according to fish size. It was assumed that the diet of otter consisted 50% of fish < 30 cm in size and 50% fish >30 cm; all other piscivores were assumed to consume only fish <30 cm in size. In the K-1007 pond, mean (±SE) PCB-1254 and PCB-1260 concentrations in fish <30 cm in size were 0.08 ± 0.02 mg/kg and 0.1 ± 0.05 mg/kg, respectively. In contrast, PCB-1254 and PCB-1260 concentrations in fish >30 cm in size were 21.3 ± 13 mg/kg and 20.8 ± 13 mg/kg, respectively. Mink, kingfisher, and heron experience minimal risk at the K-1007 pond because the fish they consume have low PCB concentrations. In contrast, because otter would be expected to consume the larger fish with the higher bodyburdens, the risk they experience at the same location is significant. At the K-901 pond, while PCBs were only detected in small fish (shad), concentrations in these fish were high (6.2 ± 1.4 mg/kg). As a result, significant risks are estimated for all piscivores at this location.

Similar to K-25, the pattern of cumulative risk in the White Oak Creek watershed was similar for mink (Fig. C.9a), kingfisher (Fig. C.9c), and herons (C.9d) but different for otters (C.9b). In general, cumulative risk was greater in White Oak Creek than in it's tributaries (NTK and MEK) and declined with increasing distance from the X-10 plant. Mercury was the primary risk agent for kingfisher and heron (Figs. C.9c and C.9d), while PCBs were the primary factor for mink and otter (Figs. C.9s and C.9b). A peak for risk to otters from PCBs was observed at White Oak Lake. This peak can be attributed to the presence of data for large fish (>30 cm); PCBs in large fish were 3 to 5 times higher than that in small fish (Table C.6).

#### 4.4.1.2 Screening Monte Carlo simulation estimates of exposure

To incorporate the variation present in the parameters employed in the exposure model, Monte Carlo simulations were performed for exposure of each species to mercury and PCBs in each watershed. Simulations for mercury and PCBs in East Fork Poplar Creek were performed both with and without the EFPC RI data to determine the influence of these data points. Additional simulations were performed for any analyte-endpoint-watershed combination where at least one LOAEL-based HQ>1 was observed or where data were adequate to evaluate an entire watershed. These additional simulations included exposure of mink and otter to cadmium and selenium in Bear Creek; exposure of mink and otter to cadmium in White Oak Creek; exposure of kingfisher and heron to DDT in East Fork Poplar Creek; and exposure of kingfisher and heron to chromium from the K-901 pond. For comparison, simulations of exposure to PCBs and mercury at the off-site locations were performed for all species. Additional simulations were performed to evaluate off-site exposure of mink and otter to cadmium and selenium and of kingfisher and heron to chromium and DDT.

Monte Carlo simulations were performed on the mean exposure for each watershed (i.e., mean of sampling locations). It was assumed that each sampling location contributes equally to the overall mean exposure (i.e., the individuals within each watershed do not preferentially forage at any one location within the watershed). The mean, standard deviation, and 80th percentile of the simulated exposures are presented in Table C.17. By superimposing NOAEL and LOAEL values on these distributions, the likelihood of an individual experiencing potentially hazardous exposures can be estimated and the magnitude of risk may be determined. Interpretation of the comparison of exposure distributions to NOAELs and LOAELs is described in the following table:

| Comparison | Meaning | Risk-based interpretation |
|---|---|---|
| NOAEL>80th percentile of exposure distribution | Less than 20% of exposures >NOAEL | Individual- and population-level adverse effects are highly unlikely |
| NOAEL<80th percentile<LOAEL | More than 20% of exposures >NOAEL, but less than 20% of exposures >LOAEL | Individuals experiencing exposures at the high end of the distribution may experience adverse effects, but those effects are unlikely to significantly contribute to effects on the ORR population |
| LOAEL<80th percentile of exposure distribution | More than 20% of exposures >LOAEL | Effects on some individuals are likely and they may contribute significantly to effects on the ORR population |

To evaluate the likelihood and magnitude of population-level effects on piscivores, literature-derived population density data (expressed as number of individuals/km of stream or pond shoreline) were combined with lengths of streams or pond shorelines for which risks were assessed to estimate the number of individuals of each endpoint species expected to be present in each watershed. Literature-derived population densities used for each endpoint species were: mink: 0.6/km; river otter 0.37/km; belted kingfisher: 0.4/km; and great blue heron; 2.3/km. It should be noted that density values for all endpoint species but the great blue heron represent the maximum values obtained from the literature (see Tables C.1, C.2, and C.3). The values for herons (see Table C.4) appear inflated and are not believed to accurately represent densities on the ORR. For this reason, the minimum value was used. Population estimates based upon these densities are listed in the following table.

| | Watershed length (km) | | | Estimated number of individuals by watershed | | | |
|---|---|---|---|---|---|---|---|
| Watershed | Stream length | Pond shoreline length | Total length | Mink | River otter | Belted kingfisher | Great blue heron |
| Bear Creek | 12.4 | 0 | 12.4 | 7 | 5 | 5 | 29 |
| East Fork Poplar Creek | 24.8 | 0 | 24.8 | 15 | 9 | 10 | 57 |
| K-25 | 18.4 | 5.2 | 23.6 | 14 | 9 | 9 | 54 |
| White Oak Creek | 3.9 | 2.5 | 6.4 | 4 | 2 | 3 | 15 |
| ORR total | | | | 40 | 25 | 27 | 155 |

The number of individuals within a given watershed likely to experience exposures >LOAELs can be estimated using cumulative binomial probability functions (Dowdy and Wearden 1983). Binomial probability functions are estimated using the following equation:

$$b(y;n;p) = \binom{n}{y} p^{y} (1-p)^{n-y} \qquad \textbf{(4)}$$

where:

y = the number of individuals experiencing exposures >LOAEL
n = total number of individuals within the watershed
p = probability of experiencing an exposure in excess of the LOAEL
b (y; n; p) = probability of y individuals out of a total of n, experiencing an exposure >LOAEL, given the probability of exceeding the LOAEL = p.

By solving Equation 4 for y = 0 to y = n, a cumulative binomial probability distribution may be generated that can be used to estimate the number of individuals within a watershed that are likely to experience adverse effects. Summing the number within each watershed across all watersheds and dividing by the total estimated ORR-wide population, the proportion of the total ORR population potentially at risk may be estimated.

Binomial probability distributions were generated only for contaminant-endpoint-watershed combinations where the percent of the exposure distribution exceeding the LOAEL was 20% to 80% (these values are reported in Table C.17). Only two contaminant-endpoint-watershed combinations met this criterion: mercury exposure to otter in East Fork Poplar Creek (Fig. C.10) and PCB exposure to otter in K-25 area (Fig. C.11). Three of nine otter in East Fork Poplar Creek may be adversely affected by mercury exposure (Fig C.10); six of nine otter in the K-25 area may be adversely affected by PCB exposure (Fig C.11) (the number of individuals where the cumulative probability of exceeding the LOAEL >0.5).

If the percent of the exposure distribution exceeding the LOAEL was <20%, it was assumed that no individuals within that watershed were experiencing adverse effects. Conversely, if the percent of the exposure distribution exceeding the LOAEL was >80%, it was assumed that all individuals within that watershed were experiencing adverse effects.The total numbers of individuals for each endpoint species estimated to be experiencing adverse effects within each watershed and across the ORR are summarized in Table C.21.

Inclusion or exclusion of the EFPC RI data generally had little effect on the exposure estimates for any species in East Fork Poplar Creek (Table C.17). While mean estimated exposure varied somewhat (lower for mercury and higher for PCBs with the EFPC RI data excluded), conclusions concerning the presence or absence of risk were constant regardless of whether or not the EFPC RI data were included. The only exception was for exposure of otter to mercury. Exclusion of the EFPC RI data reduced the likelihood of exceeding the LOAEL by over 50% (Table C.17). As a consequence, the number otter estimated to be adversely affected by mercury in East Fork Poplar Creek ranged from three to nine individuals, and the percent of the potential ORR-wide population at risk ranged from 12 to 36 % (Table C.21).

For mink, only one contaminant (cadmium) in one watershed (Bear Creek) presented a significant risk (LOAEL <80th percentile of exposure distribution, Table C.17). Mean estimated cadmium exposure in Bear Creek is 30-60 times greater than that estimated in White Oak Creek or at an off-site location (Hinds Creek). Using only cadmium exposure data from Bear Creek and White Oak Creek, 17.5% of the estimated ORR-wide mink population is likely to be adversely affected by cadmium (Table C.21). Exposure of mink to mercury, PCBs, and selenium at all locations on the ORR, while greater than NOAELs (NOAEL <80th percentile of exposure distribution) was not greater than LOAELs, indicating that while individual mink that may forage in the more contaminated areas may experience adverse effects, the mink population on the ORR as a whole is unlikely to adversely affected.

Several contaminants present significant hazards to otter (LOAEL <80th percentile of exposure distribution): cadmium in Bear Creek, mercury in East Fork Poplar Creek, and PCBs in East Fork Poplar Creek, and the K-25 vicinity (Table C.17). In terms of risks to the potential ORR-wide otter population, about 20% of the population could be adversely affected by cadmium, 12% or 36% by mercury, and 60% by PCBs (Table C.21). These data suggest that the successful re-establishment of otter on the ORR may be limited by contamination. In comparison to estimated exposures at off-site locations, cadmium exposure in Bear Creek is approximately 100 times greater, mercury exposure in East Fork Poplar Creek is 10 to 15 times greater, and PCB exposures in East Fork Poplar Creek, K-25, and across the ORR are about 10 times greater than that at one of two off-site locations (Hinds Creek; Table C.17). Estimated PCB exposure at the other off-site location (Brushy Fork) exceeds the highest observed on the ORR, suggesting that this off-site location is contaminated. Exposure of otter to selenium in Bear Creek, while greater than the NOAEL (NOAEL <80th percentile of exposure distribution) was not greater than the LOAEL (Table C.17).

Similar risk results were obtained for both kingfisher and heron: mercury presents a significant hazard (LOAEL <80th percentile of exposure distribution) to both species in East Fork Poplar Creek

(Table C.17) and as a result to their ORR-wide populations (Table C.21). Additionally, chromium in the K-901 pond presents a hazard to individual kingfisher and heron that may feed extensively from this pond. Mean estimated mercury exposure in East Fork Poplar Creek and on the ORR as a whole is 5-20 times greater than that estimated at three off-site locations; chromium in K-901 is approximately 20 times greater that observed off site (Table C.17). Exposure of kingfisher or heron to DDT or PCBs, while greater than NOAELs at all locations on the ORR (NOAEL<80th percentile of exposure distribution) was not greater than LOAELs.

#### 4.4.1.3 Effects of retained contaminants

**Cadmium.** The mink and otter NOAEL and LOAEL for cadmium were derived from a study of rats fed cadmium chloride for 4 generations. (Wills et al. 1981). While consumption of 0.01 mg/kg/d cadmium reduced fertility (no. litters/no. females) by 63%, no adverse effects were observed at a 0.008 mg/kg/d exposure level. The study was considered to represent a chronic exposure, therefore a subchronic-chronic correction factor was not employed. The 0.008 mg/kg/d exposure was considered to be a chronic NOAEL; the 0.01 mg/kg/d exposure was considered to be a chronic LOAEL Based on the results of Wills et al. (1981), mink or otter experiencing exposure ≥LOAEL are likely to display reduced fertility.

**Chromium.** The kingfisher and heron NOAEL and LOAEL for chromium were derived from a study of black ducks fed $Cr^{+3}$ for 10 months. (Haseltine et al., unpubl. data). While consumption of 5 mg/kg/d chromium reduced duckling survival, no adverse effects were observed at a 1 mg/kg/d exposure level. The study was considered to represent a chronic exposure, therefore a subchronic-chronic correction factor was not employed. The 1 mg/kg/d exposure was considered to be a chronic NOAEL; the 5 mg/kg/d exposure was considered to be a chronic LOAEL Based on the results of Haseltine et al. (unpubl. data), kingfisher or heron experiencing exposure ≥LOAEL are likely to display reduced offspring survival.

**Mercury.** For the purposes of this assessment, it is assumed that 100% of the Hg to which piscivores are exposed consists of methylmercury.

Both the avian NOAEL and the LOAEL are based upon a study of mallard ducks fed methyl mercury for three generations (Heinz 1979). The study was considered to represent a chronic exposure and a subchronic-chronic correction factor was not employed. The only dose level administered, 0.064 mg/kg/d, caused hens to lay fewer eggs, lay more eggs outside of the nest box, and produce fewer ducklings. This dose level was considered to be a LOAEL. Because an experimental NOAEL was not established, the NOAEL was estimated using LOAEL-NOAEL correction factor of 0.1. Based on the results of Heinz (1979), birds experiencing exposure ≥LOAEL are likely to display impaired reproduction.

The otter NOAEL for mercury was derived from a study of mink fed methyl mercury for 93 d (Wobeser et al. 1976). While consumption of 0.247 mg/kg/d methyl mercury resulted in significant mortality, weight loss, and behavioral impairment, no effects were observed at the 0.15 mg/kg/d exposure level. The 0.15 mg/kg/d exposure was considered to be a NOAEL and the 0.247 mg/kg/d exposure was considered to be a LOAEL. Because the study was subchronic in duration (<1 year), a subchronic-chronic correction factor was applied (NOAEL = 0.015, LOAEL = 0.025). While the estimated chronic NOAEL based on results from Wobeser et al. (1976) was considered appropriate for screening purposes (the conservatism added by the application subchronic-chronic correction factor serves to identify areas of potential risk), the estimated chronic LOAEL based on Wobeser et al. (1976) was considered too severe and therefore inappropriate to evaluate the nature and magnitudes of potential population-level effects. Therefore the LOAEL was derived from a study that was considered to be more appropriate. The LOAEL for mercury was derived from a study that evaluated reproduction in rats fed methyl mercury for three generations (Verschuuren et al. 1976). While consumption of 0.16 mg/kg/d methyl mercury resulted in reduced pup viability, no effects were observed among rats consuming 0.032 mg/kg/d. Because the data were derived from a multigenerational study, the 0.16 mg/kg/d exposure was considered to be a chronic LOAEL. Based on the results of Verschuuren et al. (1976), otter experiencing exposure ≥LOAEL are likely to display impaired reproduction.

**PCBs.** The otter NOAEL and LOAEL for PCBs was derived from a study of mink fed Aroclor 1254 for 4.5 months (Aulerich and Ringer 1977). While consumption of 0.69 mg/kg/d Aroclor 1254 reduced kit survivorship, no effects were observed at the 0.14 mg/kg/d exposure level. The 0.14 mg/kg/d exposure was considered to be a chronic NOAEL; the 0.69 mg/kg/d exposure was considered to be a chronic LOAEL Based on the results of Aulerich and Ringer (1977), mink experiencing exposure ≥LOAEL are likely to display reduced kit survivorship.

### 4.4.2 Mink Toxicity Tests

To evaluate the nature and magnitude of toxicity of contaminants in fish from the Clinch River to mink, fish were collected from the Poplar Creek embayment, formulated into mink diets, and fed to mink. Mink were fed five different diets. Ten mink (2 males, 8 females) were fed each diet for 7 months; starting approximately 3 months prior to breeding, extending to 6 weeks post-partum. Bioaccumulation, growth, histopathology, and reproduction were recorded. Significant effects were observed only among mink fed diet E. These effects included statistically significant reductions in body weights of adult females and male kits and in litter size. Percent reductions were 20% and 17% for adult female and male kit weights, respectively, and 37.7% for litter size. A detailed discussion of the methods and results of the mink toxicity test is presented in Appendix-E.

To evaluate how the exposures experienced by mink in the toxicity test compare to those modeled for mink on the ORR, Monte Carlo simulations of mink exposure were performed using the concentrations of mercury and PCB 1260 measured in the five diets (Tables F.1 and F.5, Appendix E). Parameter values in the exposure model were those used in estimates on the ORR (body weight = 0.974 ± 0.202 kg; food ingestion rate = 0.137 kg/d). Results of the exposure simulation are presented in Table C.22. Estimated exposures to mercury and PCB 1260 in diet A were below both the NOAEL and LOAEL. For diets B, C, D. and E, mercury exposures exceeded the NOAEL (only marginally for diet B) but not the LOAEL, suggesting that it is possible but unlikely that toxicity observed in diet E is attributable to mercury. However, exposures to Aroclor 1260 in diets B, C, D, and E were greater than both the NOAEL and LOAEL (Table C.22). These data suggest that toxicity was due primarily to PCBs rather than mercury and that impaired reproduction should have been evident in all four diets, not just diet E.

Estimating that toxicity should be observed in four diets, but actually observing it only in the highest concentration suggests that the LOAEL for PCBs used in this assessment is too low and is not representative of the toxicity of the PCBs present on the ORR. ORR-specific NOAEL and LOAEL for PCBs (represented by PCB 1260) of 1.7 mg/kg/d and 3 mg/kg/d can be derived from the toxicity test exposure estimate for diets B and E (Table C.22). While an ORR-specific LOAEL for mercury cannot be derived from these toxicity test results, a site-specific NOAEL may be estimated. The ORR-specific NOAEL for mercury would be 0.022 mg/kg/d (diet D) or 0.033 mg/kg-d (diet E, assuming that mercury is not contributing significantly to toxicity observed from this diet).

The mercury exposure estimate for mink in the watershed where the highest exposure estimate was obtained (East Fork Poplar Creek; mean = 0.067 ± 0.029 mg/kg/d) is higher than that estimated for all test diets (Table C.22). The estimated total PCB exposure in East Fork Poplar Creek (excluding EFPC RI data; mean = 0.35 ± 0.17 mg/kg/d) is less than that in all test diets except the control diet (diet A; Table C.22).

Several conclusions may be drawn from these toxicity test data.

- Comparisons of exposure estimates to NOAELS and LOAELs suggest that effects observed in diet E are attributable to PCBs. It is unlikely that mercury is significantly contributing to adverse effects observed in the toxicity test. A significant contribution of mercury to the toxic effects would have resulted in a LOAEL that was lower than literature values, not higher.

- Given the difference between predicted and observed toxicity from the test diets, the PCB LOAEL used in this assessment is too low and does not reflect toxicity observed among mink exposed to Poplar Creek fish.

- Consumption of a diet consisting of 75% fish from the Poplar Creek produces reproductive impairment in mink.

- Assuming that toxicity in the test is entirely due to PCBs, a LOAEL for mink on the ORR fish of 3 mg/kg/d can be derived. Using the ORR-specific value rather than the literature value, PCBs would not be expected to cause toxic effects on survival, growth, or reproduction of mink in any ORR watershed.

Differences between the results of the toxicity tests and modeled exposures for mink on the ORR may result for several reasons.

- Differences in fish size. Exposure estimates for mink on the ORR were based solely on contaminant concentrations in fish most likely to be consumed by mink (i.e., ≤30 cm in length). Due to the large volume of fish needed to formulate the test diets and to feed mink for 7 months, the majority of fish used in the toxicity test were large (mean = 39 cm, STD = 17 cm). Because body burdens of bioaccumulative contaminants like mercury and PCBs are generally greater in older, larger individuals, concentrations in the toxicity test diets were higher than that in fish expected to be consumed by mink on the ORR.

- Differences in fish species. More than 50% of the fish used in the test diets were sucker, carp, or buffalo (Table E.1, Appendix E). None of these species were included in the data used to estimate mink exposure on the ORR. Because fish species accumulate contaminants differently (as seen in stonerollers and sunfish in Bear Creek), variation in species included in test diets and modeled diets may have contributed to the differences in results.

- Differences in the PCB congener composition on the ORR vs. that used in the literature toxicity test. PCBs measured in environmental samples are not Aroclors. Aroclors are specific mixtures of PCB congeners as manufactured. The environmental measurements of PCBs used in the

Poplar Creek toxicity test are called PCB 1254 or PCB 1260 because they have ~54% or 60% Cl. The congener makeup of PCB 1254 or 1260 from the Poplar Creek fish is likely to be very different from the congener makeup of Aroclor 1254 or 1260. More importantly, PCB toxicity is generally correlated with individual congeners, not with Aroclors.

### 4.4.3 Biological Surveys

#### 4.4.3.1 Great blue heron reproduction study

To determine if contaminants from the ORR are adversely affecting great blue heron, bioaccumulation of contaminants and reproductive success of herons at two colonies located adjacent to the ORR and two colonies located >10 km from the site was monitored. Data were collected from each nest colony between 1992 and 1994. A detailed discussion of these data are presented in Appendix F.

Analyses indicated statistically significantly elevated levels of Cr, Hg, and PCBs in eggs (Tables F.2 and F. 4, Appendix F), Hg in feathers and liver of chicks (Table F.3, Appendix F) and PCBs in fat (Table F.5, Appendix F), liver (Table F.6, Appendix F), and muscle (Table F.7, Appendix F) of chicks from samples from the ORR as compared to data from the off-site locations. King et al. (1991) report that 0.5 to 1.5 mg/kg mercury concentrations in bird eggs may are associated with reproductive failure; Harris et al. (1993) report a NOAEL for hatching success of Forster's Tern eggs to be 7 mg/kg. Mean concentrations of mercury (0.17 mg/kg) and PCBs (1.68 mg/kg) in great blue heron eggs from within 3 km of the ORR are substantially below both levels, suggesting that reproductive effects from mercury or PCBs in eggs are unlikely.

Despite elevated contaminant burdens, the mean number of eggs/nest, number of chicks/nest, egg weight, and eggshell thickness did not differ between colonies within 3 km of the ORR and those >10 km away (Table F.8; Appendix F). In addition, the number of eggs/nest observed at the colonies within 3 km of the ORR (3.5 eggs/nest) and at the colonies >10 km away (3.2 eggs/nest) are comparable to those reported in EPA (1993b) (3.16 to 4.37 eggs/nest).

The results of the great blue heron reproduction survey indicate that herons are experiencing higher contaminant exposures at the colonies adjacent to the ORR. However, this exposure is not sufficiently high to result in adverse effects to the populations at the studied colonies. [Note: there are currently five great blue heron colonies around the margins of the ORR (R. Brewer, pers. comm.). Bioaccumulation and reproductive success have only been evaluated for two of these five colonies.]

#### 4.4.3.2 Mink survey

Results of the mink survey (see Sect. 4.3.3) indicate that mink are present on the ORR, have large home ranges and do not avoid the industrial facilities on the ORR. The methods employed in the study do not allow numbers or density of mink to be determined. While mercury levels in hair of mink were statistically significantly greater on the ORR than in reference samples, no statistically significant differences were observed for arsenic, cadmium, lead, or selenium.

## 4.4.4 Weight of Evidence

### 4.4.4.1 Mink

Three lines of evidence, literature toxicity data, toxicity test data, and field surveys were available to evaluate risk to mink. Comparison of exposure estimates to LOAELs indicates a significant risk from cadmium in Bear Creek. While data for cadmium exposure are lacking for East Fork Poplar Creek and the K-25 area, cadmium in the Bear Creek drainage is estimated to present a risk to 17.5% of the ORR-wide mink population (Table C.21). Data concerning cadmium in fish at K-25 and East Fork Poplar Creek are needed to determine if cadmium presents a serious risk (i.e., percent exposed ≥20%) to the ORR-wide mink population.

While no risks were identified in any other watershed or on the ORR as a whole for any other contaminant evaluated singly, it should be noted that Wren et al. (1987) report a synergistic effect of combined exposure of mink to PCBs and methylmercury. While the most severe effects (50% reduction in kit survival) were observed among mink consuming 0.14 mg/kg/d each of PCB and methylmercury), consumption of 0.07 mg/kg/d each of PCB and methylmercury produce a 13% reduction in kit survival and reduced the mean number of kits/female by 20%. While exposure of mink to PCBs at all locations on the ORR exceeded the highest effects level (0.14 mg/kg/d; Table C.17), only in East Fork Poplar Creek does mercury exposure exceed the lower effects level (0.07 mg/kg/d). Because Wren et al. (1987) only considered the synergistic effects of equal exposures to PCBs and methylmercury, combined effects of PCBs and methylmercury in the proportions present on the ORR are unknown (except for Poplar Creek).

Toxicity test results indicate that consumption of a diet consisting primarily of fish from the Poplar Creek embayment adversely affects mink reproduction. Because PCB exposure in four of the five diets (Table C.22) were 5 to 22 times higher than highest dose level in Wren et al. (1987; 0.14 mg/kg/d) while the mercury level in the highest diet (diet E) was less than half the lower dose level in Wren et al. (1987), and PCB exposure in 4 of five test diets exceeded PCB LOAELs while no diet exceeded mercury LOAELs (Table C.22), effects observed in the toxicity test using Poplar Creek fish are most likely attributable to PCBs. The maximum PCB exposure estimated for mink on the ORR however is significantly lower than the toxicity test exposure level that produced effects.

Limited data from field surveys indicate that while mink are present on the reservation, the health and abundance of the population is unknown (the trapping methods that were employed, while suitable for capturing animals for radiotelemetry purposes, were not adequate to estimate population abundance and density). Mink on the ORR have large home ranges, make use of the creeks within the industrial facilities, and have higher mercury concentrations in hair than do mink from off-site locations. Cd concentrations in hair were not different between mink on the ORR and those from off-site locations.

The weight of evidence suggests that Cd presents a hazard to mink in Bear Creek and consequently to a substantial portion (17.5%) of the ORR-wide mink population. ORR-wide risk to mink from cadmium may be underestimated due to the lack of data from the two largest watersheds (i.e., East Fork Poplar Creek and the K-25 vicinity). Combined exposure of mink to PCBs and mercury may present a hazard to mink in East Fork Poplar Creek. Risks from contaminants in other watersheds are not significant (Table 4.1).

**Table 4.1. Summary of risk characterization for piscivores on the ORR**

| Species | Evidence | Result | Explanation |
| --- | --- | --- | --- |
| Mink | Literature toxicity data | + | Estimated Cd exposure in the Bear Creek watershed exceeds LOAELs. Effects from combined exposure to PCBs and Hg may produce adverse effects to mink in East Fork Poplar Creek. |
| | Biological surveys | ± | Mink are present on the ORR, but abundance and density are unclear but clearly not high. While Hg in hair from mink from ORR is elevated relative to references, As, Cd, Pb, and Se are not.. |
| | Medium toxicity tests | - | A diet consisting primarily of fish from Poplar Creek adversely affects reproduction, with effects attributed to PCBs. The maximum PCB exposure estimated for mink on the ORR however is significantly lower than the toxicity test exposure level that produced effects. This is likely the results of higher proportion of fish in the toxicity test diet and variation in the congener makeup of PCBs on the ORR vs that in the literature toxicity tests. |
| | Weight of evidence | + | Cd presents a hazard to mink in Bear Creek and consequently to 17.5% of the ORR-wide mink population. Combined exposure of mink to PCBs and mercury may present a hazard to mink in East Fork Poplar Creek. Risks from contaminants in other watersheds are not significant. |
| River otter | Literature toxicity data | + | Comparison of exposure estimates to LOAELs indicates a significant risk from cadmium in Bear Creek, from mercury in East Fork Poplar Creek, and from PCBs in East Fork Poplar Creek, and the K-25 vicinity. |
| | Biological surveys | NA | |
| | Medium toxicity tests | - | Use of the ORR-specific PCB LOAEL generated from the mink toxicity test indicates that PCBs on the ORR are unlikely to adversely affect otter. The ORR-specific mercury NOAEL while greater than the literature-based NOAEL, is less than the literature-based LOAEL. Conclusions concerning risk to otter from mercury are therefore unaffected by the results of the mink toxicity test. |
| | Weight of evidence | + | Because the river otter is a state threatened species, effects to any individual are significant. Consequently, cadmium in Bear Creek, mercury in East Fork Poplar Creek, present a significant risk to a potential ORR-wide otter population. |

**Table 4.1 (continued)**

| Species | Evidence | Result | Explanation |
|---|---|---|---|
| Belted kingfisher | Literature toxicity data | + | Comparison of exposure estimates to LOAELs indicates a significant risk from mercury in East Fork Poplar Creek and on the ORR as a whole. Individual kingfisher foraging from the K-901 pond may be adversely affected by chromium. |
| | Biological surveys | NA | |
| | Medium toxicity tests | NA | |
| | Weight of evidence | + | Mercury in East Fork Poplar Creek presents a significant risk to the ORR-wide belted kingfisher population. |
| Great blue heron | Literature toxicity data | + | Comparison of exposure estimates to LOAELs indicates a significant risk from mercury in East Fork Poplar Creek and on the ORR as a whole. Individual heron foraging from the K-901 pond may be adversely affected by chromium. |
| | Biological surveys | - | Biomonitoring data at 2 of 5 colonies around the ORR indicate that while PCBs and mercury are being accumulated in heron eggs and chicks, the levels in eggs are lower than levels reported in the literature to produce adverse effects. Observations of the two of the five colonies adjacent to the ORR indicate that reproduction is not reduced relative to colonies >10 km from the ORR. |
| | Medium toxicity tests | NA | |
| | Weight of evidence | ± | Contaminant bioaccumulation and reproductive success are unknown at the three additional colonies adjacent to the ORR; the primary foraging locations for herons at the two studied colonies is unknown. Because herons can travel long distances in search of food, they are likely to forage at offsite as well as on-site locations, reducing both the exposure they receive and the risk they experience. If birds from the unstudied colonies forage more extensively on the ORR, they may experience greater risk. Due to the high risk estimated for mercury exposure on the ORR, the lack of data for three of five heron colonies adjacent to the ORR, and uncertainty as to where birds from the five ORR colonies forage, a conclusion concerning whether or not great blue heron on the ORR are at risk cannot be made |

+ indicates that the evidence is consistent with the occurrence of the endpoint effect.
- indicates that the evidence is inconsistent with the occurrence of the endpoint effect.
± indicates that the evidence is too ambiguous to interpret.
NA indicates that the information is not available.

#### 4.4.4.2 River otter

Two lines of evidence, literature toxicity data and the PCB NOAEL and LOAEL and mercury NOAEL derived from the Poplar Creek mink toxicity test, were available to evaluate potential risk to river otter. Comparison of exposure estimates to literature-derived LOAELs indicates a significant risk from cadmium in Bear Creek, from mercury in East Fork Poplar Creek, and from PCBs in East Fork Poplar Creek, and the K-25 vicinity.

Using Equation 3 and the ORR-specific PCB NOAEL and LOAEL and mercury NOAEL for mink (see Sect. 4.4.2), ORR-specific values for otter were estimated to be as follows:

| Analyte | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
|---|---|---|
| PCBs | 0.85 | 1.5 |
| Mercury | 0.011[a] | no data |

[a]To be conservative, based on the lower of two possible NOAELs.

Comparison of the ORR-specific PCB LOAEL to the exposure distributions presented in Table C.17 indicate that there is a <1% likelihood of individuals in any watershed experiencing PCB exposure >ORR-specific LOAEL. Therefore, based upon the results of the Poplar Creek mink toxicity test, PCBs are unlikely to present a significant risk to the ORR-wide otter population.

The ORR-specific mercury NOAEL, while greater than the literature-derived NOAEL (0.008 mg/kg/d; Table C.18) is still less than the literature-derived LOAEL (0.06 mg/kg/d; Table C.18). Therefore, the results of the Poplar Creek mink toxicity test do not significantly alter the conclusions derived from evaluation of the literature-based toxicity data.

Evaluation of the potential risks to a future ORR-wide population of otter indicates that cadmium in Bear Creek presents a risk to 20% of the ORR-wide population; mercury in East Fork Poplar Creek presents a risk to either 12% or 36% (Table C.21; depending upon inclusion of EFPC RI data). Because the river otter is a state threatened species, effects to any individual is significant. Therefore the weight of evidence suggests that Cd in Bear Creek, mercury in East Fork Poplar Creek, all present a significant risk to future ORR-wide river otter population (Table 4.1).

#### 4.4.4.3 Belted kingfisher

One line of evidence, literature toxicity data, was available to evaluate potential risk to belted kingfisher. Comparison of exposure estimates to LOAELs indicates a significant risk from mercury in East Fork Poplar Creek (Table C.17). This translates into a risk to 37% of the ORR-wide kingfisher population (Table C.21). Individual kingfisher foraging from the K-901 pond may be adversely affected by chromium. The weight of evidence suggests mercury in East Fork Poplar Creek presents a significant risk to the ORR-wide belted kingfisher population (Table 4.1).

#### 4.4.4.4 Great blue heron

Two lines of evidence, literature toxicity data and biomonitoring data, were available to evaluate ecological risk to great blue heron. Comparison of exposure estimates to LOAELs indicates a significant risk from mercury in East Fork Poplar Creek (Table C.17). This translates into a risk to 37% of the ORR-wide heron population (Table C.21). Individual heron foraging from the K-901 pond may be adversely affected by chromium. Biomonitoring data at 2 of 5 colonies around the ORR indicate that while PCBs and mercury are being accumulated in heron eggs and chicks, the levels in eggs are lower than levels reported in the literature to produce adverse effects. Observations of the two of the five colonies adjacent to the ORR indicate that reproduction is not reduced relative to colonies >10 km from the ORR. Contaminant bioaccumulation and reproductive success are unknown at the three additional colonies adjacent to the ORR. Additionally, the primary foraging locations for herons at the two studied colonies is unknown. Because herons can travel long distances in search of food (>15 km), they are likely to forage at off-site as well as on-site locations, reducing both the exposure they receive and the risk they experience. If birds from the unstudied colonies forage more extensively on the ORR, they may experience greater risk. Due to the high risk estimated for mercury exposure on the ORR, the lack of data for three of five heron colonies adjacent to the ORR, and uncertainty as to where birds from the five ORR colonies forage, a conclusion concerning whether or not great blue heron on the ORR are at risk cannot be made (Table 4.1).

### 4.4.5 Quality and Completeness of Data

The fish bioaccumulation data used in the piscivore assessment was considered to be of high quality. Except for the East Fork Poplar Creek RI data, all data were obtained directly from the PIs (principal investigators) who collected the data. Because these persons were available to answer questions concerning interpretation of their data, few assumptions concerning sampling methods, measurements, sampling locations, and so forth were necessary. The East Fork Poplar Creek RI data was also considered to be of high quality, but there is considerable uncertainty concerning the variation in measurements observed in these data as compared to BMAP data from East Fork. Reasons for this discrepancy will be investigated.

Most fish bioaccumulation data that we were aware of was used in this report. Data that were not included at this time but will be in future assessments include data from the Clinch River RI program, data from the WAG 1 surface impoundments, and fish data collected by the Environmental Compliance Division.

The most severe limitation of the data used in this assessment relates to contaminants analyzed for in fish tissue. While data for PCBs and mercury were available at all locations, that for other contaminants was not. Consequently, reservation-wide scale risks that these contaminants may present cannot be evaluated at this time. BMAP has performed more extensive residue analyses in fish from selected locations on the ORR. These data are reported in various BMAP reports but are not currently in a readily usable form. These data will be added to the current reservation-wide database and will be incorporated into future revisions of this report.

### 4.4.6 Uncertainties Concerning Risks to Piscivorous Wildlife

#### 4.4.6.1 Bioavailability of contaminants

Bioavailability of contaminants was assumed to be comparable between fish collected from the ORR and the diets used in the literature toxicity tests. Because bioavailability may not be comparable, exposure estimates based upon the contaminant concentrations in ORR fish may either under- or overestimate the actual contaminant exposure experienced.

#### 4.4.6.2 Extrapolation from published toxicity data

While published toxicity studies are available for mink, there are no published data for otter, kingfisher, or great blue heron. To estimate toxicity of contaminants at the site, it was necessary to extrapolate from studies performed on test species (i.e., mallard ducks, ring-necked pheasant, and rats). While it was assumed that toxicity could be estimated as a function of body size, the accuracy of the estimate is not known. For example, osprey or herons may be more or less sensitive to contaminants than ducks or pheasants, due to factors other than metabolic rate.

Additional extrapolation uncertainty exists for those contaminants for which data consisted of only LOAELs or tests were subchronic in duration. For either case, an uncertainty factor of 10 was employed to estimate NOAELs or chronic data. The uncertainty factor of 10 may either over- or underestimate the actual LOAEL-NOAEL or subchronic-chronic relationship.

Toxicity of PCBs to piscivorous wildlife was evaluated using toxicity data from studies on Aroclor 1254. Because toxicity of PCB congeners can vary dramatically, the applicability of data for Aroclor 1254 is unknown. Comparison of the results of the mink toxicity test results and the estimated LOAELs for mink, suggests the Aroclor 1254 data do not accurately reflect (i.e., overestimate) the toxicity of the PCB mixture present in Clinch River fish.

#### 4.4.6.3 Variable food consumption

While food consumption by piscivorous wildlife was assumed to be similar to that reported for the same or related species in other locations, the validity of this assumption cannot be determined. Food consumption by wildlife on the ORR may be greater or less than that reported in the literature, resulting in either an increase or decrease in contaminant exposure.

#### 4.4.6.4 Single contaminant tests vs exposure to multiple contaminants in the field

While piscivores on the ORR are exposed to multiple contaminants concurrently, published toxicological values only consider effects experienced by exposures to single contaminants. Because some contaminants to which wildlife are exposed can interact antagonistically, single contaminant studies may overestimate their toxic potential. Similarly, for those contaminants that interact additively or synergistically, single contaminant studies may underestimate their toxic potential.

#### 4.4.6.5 Inorganic forms or species present in the environment

Toxicity of metal species varies dramatically depending upon the valence state or form (organic or inorganic) of the metal. For example, Arsenic (III) and methyl mercury are more toxic than arsenic (V) and inorganic mercury, respectively. The available data on the contaminant concentrations in media do not report which species or form of contaminant was observed. Because benchmarks used for comparison represented the more toxic species/forms of the metals (particularly for arsenic and mercury), if the less toxic species/form of the metal was actually present in fish from the Clinch River or Poplar Creek, potential toxicity at the sites may be overestimated.

#### 4.4.6.6 Contaminant concentrations in aquatic prey

While fish are the primary prey of piscivores, other aquatic prey are also consumed. It was assumed that the contaminant concentration in fish was representative of that in other aquatic prey. Due to the different life histories of other aquatic prey (i.e., amphibians, crayfish, benthic invertebrates), their contaminant burdens are likely to differ from that in fish. Therefore, assuming comparability to fish may either over or underestimate exposure.

#### 4.4.6.7 Fish size selection

Data concerning the sizes of fish consumed by piscivores were obtained from the literature. Because fish sizes consumed by piscivores on the ORR may differ from that reported in the literature, exposure may be overestimated or underestimated.

#### 4.4.6.8 Monte Carlo simulation

To perform Monte Carlo simulations, distributions must be assigned to parameters. Because wildlife are mobile, the mean of the contaminant concentration is likely to best represent their exposure. For this report, the contaminant concentrations in fish were assumed to be normally distributed. In future revisions of this report, goodness-of-fit analyses will be performed to determine which distribution best fists the data.

The literature values used for body weights of each endpoint are nationwide values which may overestimate or underestimate the body weight of species found at the site. Similarly the proportion of fish and aquatic prey in mink diet were derived from data from northern locations (i.e., MI, Canada, etc.). The applicability of these data to the percentage of fish and aquatic prey consumed by mink in Tennessee is unknown.

#### 4.4.6.9 Estimated whole fish concentrations

Contaminant concentrations in whole fish were estimated using contaminant specific fillet to whole fish ratios. Data to generate ratios were available only for PCBs in largemouth bass and channel catfish from the Clinch River. Ratios for metals were obtained from spotted bass samples from near the PORTS facility in Ohio. Applicability of these ratios to species other than those from which they were developed is unknown. Similarly, applicability of metal ratios from Ohio spotted bass to fish on the ORR is unknown.

# 5. ASSESSMENT OF RISKS TO VERMIVORES AND HERBIVORES ON THE OAK RIDGE RESERVATION

## 5.1 PROBLEM FORMULATION

On the ORR, while most wide-ranging wildlife species reside primarily in the uncontaminated terrestrial habitats outside of source OUs (the terrestrial integrator OU; Suter et al.1994a), they may also use those source OUs on which suitable habitat is present. As discussed in Chap. 3, the degree to which a source OU is used (and therefore the risk that it may present) is dependant upon the availability of suitable habitat on the OU. OUs with little or no habitat will experience little use (and will present minimal risk) while those with considerable habitat are likely to experience considerable use (and depending upon the degree of contamination, may present significant risks).

While *individuals* may experience adverse effects through exposures received at source OUs, the primary concern for ecological risk assessment is for effects at the population-level (except for T&E species, for which effects to individuals are a critical concern). To evaluate effects to the reservation-wide wildlife populations, habitat suitability and population density on the ORR and within OUs must be considered. A general, 6-step, habitat-based approach was developed that is applicable to all wildlife species on the ORR. The approach is outlined here.

1. Individual-based contaminant exposure estimates are generated for each OU using the generalized exposure model outlined in Sample and Suter (1994). Data used for the exposure estimate may consist of modeled data or actual measured concentrations in food, water, or soil from the OU.

2. Contaminant exposure estimates are compared to NOAELs or LOAELs to determine the magnitude and nature of effects that may result from exposure at the OU. If the exposure estimate >LOAEL, then individuals at the OU may experience adverse effects.

3. Availability and distribution of habitat on the ORR and within each OU is determined using the ORR habitat map presented in Washington-Allen et al. (1995; see Table B.2).

4. Habitat requirements for the endpoint species of interest (from Table B.1) are compared to the ORR habitat map to determine the area of suitable habitat on the ORR and within OUs (Tables B.4, B.5, and B.6).

5. The area of suitable habitat on the ORR and within OUs is multiplied by population density values for the selected endpoints to generate estimates of the reservation-wide population and the numbers of individuals expected to reside within each OU. Population density values may be derived from the literature or may consist of site-specific data.

6. The number of individuals for a given endpoint species expected to be receiving exposures >LOAELs for each measured contaminant is totaled. This is performed using the OU-specific population estimate from step 5 and the results from step 2. This number is then compared to the reservation-wide population to determine the proportion of the reservation-wide population that is receiving hazardous exposures. Using the 20% criterion outlined in Suter et al. (1994a), if the proportion of the reservation-wide population receiving hazardous exposures ≥20%, then an adverse population-level effect is assumed to be present.

outlined in Suter et al. (1994a), if the proportion of the reservation-wide population receiving hazardous exposures ≥20%, then an adverse population-level effect is assumed to be present.

Because contaminant concentrations in soil were the most readily available type of data and contaminant concentrations in plants and earthworms can be easily estimated using soil-plant or soil-worm uptake factors, vermivores [also known as ground invertebrate feeders (Suter et al. 1994a)] and herbivores were selected as endpoint categories to demonstrate the applicability of the habitat-based approach.

### 5.1.1 Ecological Assessment Endpoints

#### 5.1.1.1 Assessment endpoints

The following assessment endpoints selected for the assessment of risks to herbivorous and vermivorous wildlife: toxicity to white-tailed deer (*Odocoileus virginianus*) or wild turkey (*Meleagris gallopavo*) (as representative herbivores), American woodcock (*Scolopax minor*) or short-tailed shrew (*Blarina brevicauda*) (as representative vermivores), resulting in a reduction in population abundance or production. Deer, turkey, and woodcock are assessment endpoints agreed to be appropriate for the ORR by the FFA parties (Suter et al. 1994a). The shrew is identified as a measurement endpoint in Suter et al. (1994a). It is selected here as a surrogate for the several T&E shrew species listed in Suter et al. (1994a). The criteria for selection of the entities are those recommended by the EPA (Risk Assessment Forum 1992), plus considerations of scale and practical considerations.

The appropriate properties of the entities selected by these criteria depend on the level of organization of the entity and the criteria that led to their selection. While the primary concern for wildlife is effects at the population level, due to limited population sizes, effects to individuals are critical for T&E species. Because none of the selected endpoint species is a T&E species, the appropriate endpoint properties for populations of endpoint species are abundance and production.

Finally, the level of effects on these properties of the endpoint entities that is considered to be potentially significant is 20% as agreed by the FFA parties (Suter et al. 1994a). This level is consistent with current regulatory practice.

#### 5.1.1.2 Measurement endpoints

Three basic types of effects data are potentially available to serve as measurement endpoints: results of biological surveys, toxicity tests performed using fish from the ORR, and literature derived toxicity test results for chemicals found on the ORR. Measurement endpoints for each assessment endpoint are presented here.

- **White-tailed deer**
  - — Biological Survey Data—None.
  - — Media Toxicity Data—None.

- — Single Chemical Toxicity Data—These data consist of chronic toxicity thresholds for contaminants of concern in mammals with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **Wild turkey**
  - — Biological survey data—None.
  - — Media toxicity data—None.
  - — Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in birds with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **American woodcock**
  - — Biological survey data—None.
  - — Media toxicity data—None.
  - — Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in birds with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

- **Short-tailed shrew**
  - — Biological survey data—None.
  - — Media toxicity data—None.
  - — Single chemical toxicity data—These data consist of chronic toxicity thresholds for contaminants of concern in mammals with greater weight given to data from long-term feeding studies with wildlife species. Preference was also given to tests that included reproductive endpoints. These test endpoints are assumed to correspond to the assessment endpoint after allometric scaling.

### 5.1.2. Ecological Conceptual Model

The ecological conceptual model graphically represents the relationships between the contaminant sources and the endpoint receptors. It integrates the information in the other subsections of the hazard identification and presents them graphically. It is not intended to show all of the possible sources, routes of transport, modes of exposure, or effects. Rather, it includes the only identified CERCLA source, the receptors that are designated as assessment endpoint species or communities, and the major routes that result in exposure to contaminants from the ORR.

The conceptual model for exposure of herbivores and vermivores to contaminants is presented in Fig. 5.1. Components of this model include plants and soil/litter invertebrates that reside on OUs on the ORR and the herbivorous and vermivorous wildlife that feed on them. Plants and soil/litter invertebrates are exposed to contaminants from surface soil. Contaminants are

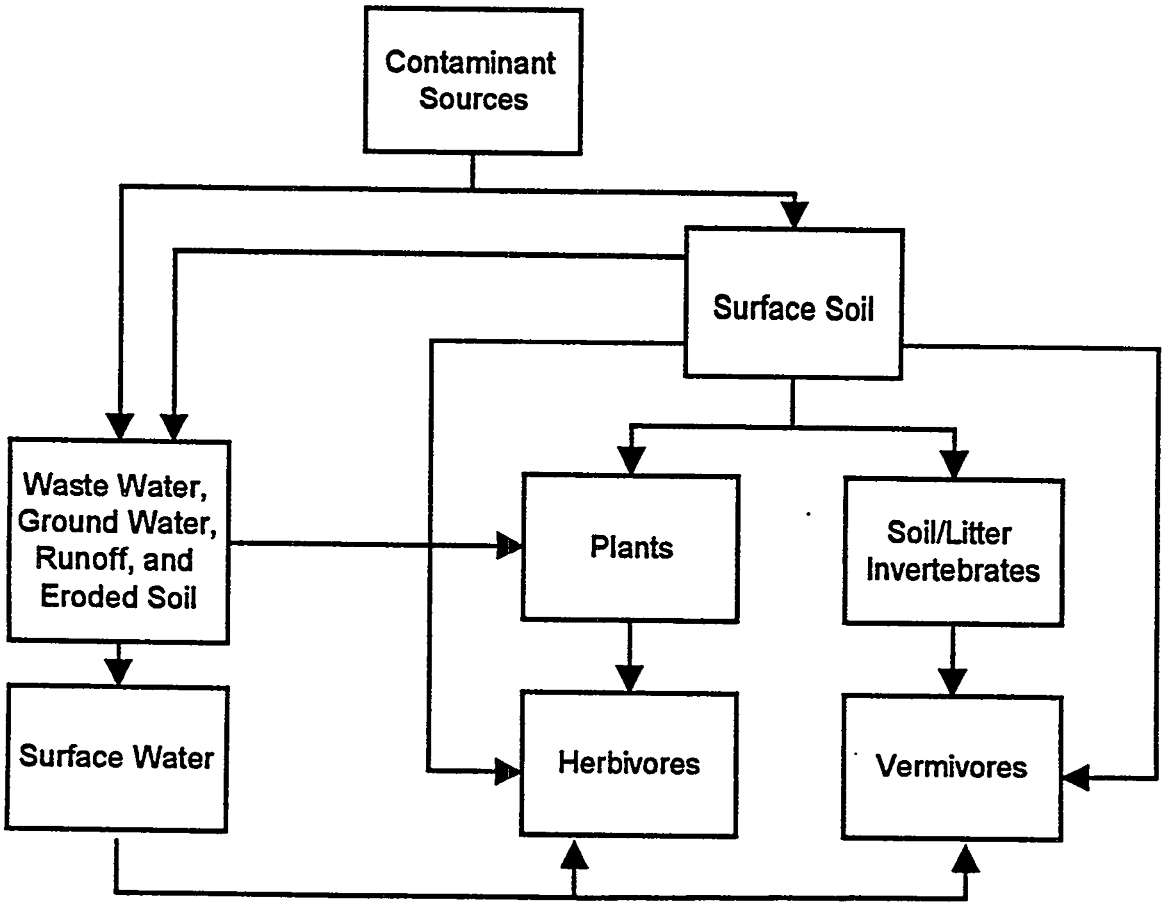


**Fig. 5.1. Conceptual model for the exposure of vermivorous and herbivorous wildlife to contaminants.**

bioaccumulated in lower trophic levels (i.e., plants or invertebrates) and transferred to higher trophic levels (i.e., herbivores and vermivores). Herbivorous and vermivorous wildlife are exposed to contaminants through consumption of plants and soil/litter invertebrates, respectively. These wildlife endpoint species are also exposed to contaminants through incidental ingestion of contaminated soil.

## 5.2 EXPOSURE ASSESSMENT FOR HERBIVOROUS AND VERMIVOROUS WILDLIFE

Potential routes of exposure for herbivorous and vermivorous wildlife inhabiting the ORR include ingestion of food (either plant or animal) and surface water. In addition, some species may ingest soil incidentally while foraging or purposefully to meet nutrient needs. The total exposure experienced by terrestrial wildlife is represented by the sum of the exposure from each individual source (e.g., vegetation or earthworms, soil, water).

The primary pathway of contaminant exposure is through oral ingestion of food and soil. Consumption of surface water, in most cases, contributes minimal contaminant exposure. Exposure from ingestion of surface water within the OU will not be included in the total exposure estimation. The surface water contaminant concentrations available in the ORR database will be compared to the water consumption benchmarks for each endpoint in the future revision of this document. Contaminant exposures were estimated for white-tailed deer, wild turkey, short-tailed shrew, and American woodcock. Exposure estimates were calculated for 12 OUs on the ORR: Bear Creek OUs 1 and 2, Lower and Upper East Fork Poplar Creek, 3 OUs at K-25 (K-1407, K-1420, K-1414), WAGs 1, 5, and 6, South Campus Facility and Chestnut Ridge OU2. Locations of these OUs on the ORR are presented in Fig. G.1.

### 5.2.1 Exposure Through Oral Ingestion of Vegetation/Soil Invertebrates and Soil

Exposure estimates were calculated for all contaminants detected at all ORR sampling locations within an OU using Equation 1 from Sect. 4.2.1. The 95% upper confidence limit (UCL) is used in exposure estimates.

#### 5.2.1.1 Life history parameters for endpoint species

Species-specific parameters for herbivorous and vermivorous endpoints necessary to estimate exposure using the above equation are listed in Tables G.1 to G.4. Habitat requirements and densities for each endpoint will be used to determine the percentage of the population which is experiencing unacceptable levels of contaminant exposure.

#### 5.2.1.2 Contaminant concentrations in biotic and abiotic media

Contaminant concentrations in soil, vegetation, and soil invertebrates are needed to estimate exposure. The surface soil 95% UCL was used to calculate incidental ingestion of soil for each endpoint species (Table G.5). However, if the contaminant was only detected in a single sample, the single concentration was used to calculate exposure. The surface soil samples which were used in the calculations were collected at a depth ranging from 0 to 2 feet. Contaminants which were not detected or do not have an associated wildlife ecotoxicological benchmark were not evaluated.

The 95% UCL soil concentrations were compared to background concentrations identified from the ORR Background Soils Characterization Project (ESD 1993: Table 6). For contaminants which exceeded background, concentrations in vegetation or earthworms within each OU were estimated using the 95% UCL soil concentration and the soil-plant or soil-earthworm uptake factors (Tables G.5, G.7, G.8, and G.9). Soil-plant uptake factors (Table G.7) were calculated for arsenic, antimony, cadmium, chromium, mercury, selenium, zinc, and uranium based on concentrations found in collocated soil and vegetation samples on Lower East Fork Poplar Creek (LEFPC) (SAIC 1993). The remaining inorganic soil-plant uptake factors were derived by Baes et al. (1984). Soil-plant uptake factors for organic contaminants were derived from the log octanol-water partition coefficient (log $K_{ow}$) using the following equation (Travis and Arms 1988; Table G.8):

$$\text{Log soil-plant uptake factor} = 1.588 - 0.578 (\log K_{ow})$$

Additionally, soil-earthworm uptake factors were calculated using contaminant concentrations found in collocated soil and earthworms collected within WAG 5 (DOE 1995) (Table G.9). Uptake factors were multiplied by either the 95% UCL or single contaminant concentration in soil to obtain the estimated contaminant concentrations found in vegetation and earthworms within each OU.

Media concentrations, including soil, vegetation (CR OU 2 only) and earthworms (WAG 5 only), were obtained from the Baseline Ecological Risk Assessments for WAG 5 and Chestnut Ridge OU2 (Sample et al. 1995; Suter et al. 1994b).

### 5.2.1.3 Exposure modeling using point-estimates

To estimate contaminant exposure experienced by white-tailed deer feeding within each OU, the following assumptions were made:

- Body weight = 56.5 kg.
- Food consumption = 1.74 kg/d.
- Soil consumption = 0.0348 kg/d.
- Diet consists 100% of vegetation.

To estimate contaminant exposure experienced by wild turkey feeding within each OU, the following assumptions were made:

- Body weight = 5.8 kg.
- Food consumption = 0.174 kg/d.
- Soil consumption = 0.0162 kg/d.
- Diet consists 100% of vegetation, seeds, and fruits.
- Contaminant concentrations in seeds and fruits are similar to vegetation.

To estimate contaminant exposure experienced by short-tailed shrew feeding within each OU, the following assumptions were made:

- Body weight = 0.015 kg.
- Food consumption = 0.009 kg/d.

- Soil consumption = 0.00117 kg/d.
- Diet consists 100% of earthworms.

To estimate contaminant exposure experienced by American woodcock feeding within each OU, the following assumptions were made:

- Body weight = 0.198 kg.
- Food consumption = 0.15 kg/d.
- Soil consumption = 0.0156 kg/d.
- Diet consists 100% of earthworms.

Using the Equation 1 from Sect. 4.2.1, the assumptions and data described above, exposure to contaminants that exceeded background concentrations was estimated for the white-tailed deer (Table G.10) wild turkey (Table G.11), short-tailed shrew (Table G12), and American woodcock Table G.13) foraging within each OU. Short-tailed shrews and American woodcock were not assessed at Chestnut Ridge OU2 since there are no earthworms present at the site due to the unsuitable fly ash habitat.

## 5.3 EFFECTS ASSESSMENT FOR HERBIVOROUS AND VERMIVOROUS WILDLIFE

### 5.3.1 Toxicological Benchmarks

To determine if the contaminant exposures experienced by herbivores and vermivores foraging on individual OUs could produce adverse effects, exposure estimates are compared to No Observed Adverse Effects Levels (NOAELs) and Lowest Observed Adverse Effects Levels (LOAELs) derived according to the methods outlined by Opresko et al. (1994) and EPA (1993b). NOAELs represent the highest exposure at which no adverse effects were observed among the animals tested. LOAELs represent the lowest exposure at which significant adverse effects are observed.

Toxicological studies of the effects of contaminants observed in the soil were obtained from the open literature. Only studies of long-term, chronic oral exposures were used to estimate the NOAEL or LOAEL. To make the NOAELs and LOAELs relevant to possible population effects, preference was given to studies that evaluated effects on reproductive parameters. In the absence of a reproduction endpoint, studies that considered effects on growth, survival, and longevity were used. The NOAELs and LOAELs for each endpoint and the studies which derived them are located in Tables G.14 and G.15. These tables present only the NOAELs and LOAELs for contaminants which had NOAEL hazard quotients greater than 1. Specific details on development of the NOAELs and LOAELs for all wildlife endpoints are discussed in Sect. 4.3.1.

### 5.3.2 Ecotoxicological Profiles for Herbivorous and Vermivorous Wildlife

The ecotoxicological profiles for chemicals of potential ecological concern (COPECs) for herbivorous and vermivorous wildlife on the ORR may be found in Appendix D. COPECs include: acetone, aluminum, arsenic, barium, cadmium, copper, 1,2 dichloroethane, lead, mercury, methylene chloride, PCBs (1254/1260), selenium, vanadium, thallium, uranium, and zinc.

## 5.4 RISK CHARACTERIZATION FOR HERBIVOROUS AND VERMIVOROUS WILDLIFE

Risk characterization integrates the results of the exposure assessment (Sect. 5.2) and effects assessment (Sect. 5.3) to estimate risks (the likelihood of effects given the exposure) based on each line of evidence. A weight of evidence approach, as outlined in Suter et al. (1994a), is applied to determine the best estimate of risk to each assessment endpoint. This risk assessment is based on only one line of evidence: literature-derived single chemical toxicity data which indicates the toxic effects of media concentrations measured within each OU.

Procedurally, the risk characterization in this assessment is performed for each assessment endpoint by:

- screening all measured contaminants within each OU against background soil levels and toxicological benchmarks;
- estimating the effects of the contaminants retained by the screening analysis for individuals of each endpoint species;
- estimating the number of individuals within the ORR population;
- estimating the number of individuals within an OU that are potentially exposed based on habitat availability and population density;
- calculating the total number of individuals on the ORR that may be at risk (addition of number of animals exposed within all OUs for which data exist);
- calculating the percentage of the ORR population that may experience adverse effects from contaminant exposure;
- using the 20% exposure criteria outlined in Suter et al. (1994a), determine if reservation-wide endpoint populations are significantly at risk from contaminants present within OUs for which data is available;
- prioritizing the OUs based on the contribution of risk to the entire ORR population; and
- discussing the uncertainties in the assessment.

Data for this assessment was limited to single chemical toxicity data and habitat availability for herbivores and vermivores inhabiting the ORR.

### 5.4.1 Contaminant Screening of Soil to Background Levels

The initial screening for COPECs in soil begins with a comparison of the 95% UCL or single detected concentration found in surface soil in each OU with appropriate ORR background soils identified in the ORR Background Soils Characterization Project (ESD 1993). Table G.6 identifies the background levels (95% UCL) found for each formation indicative of each OU. In some cases, an OU may be located on multiple formations. Therefore, a range of the minimum and maximum 95% UCL background values for multiple formations were used for comparison. Data were not available for certain formations indicative of an OU; thus the range of 95% UCLs of all formations was used. Chemicals were rejected from further consideration if the 95% UCL concentrations in soil were less than the 95% UCL background concentration for the specific formation.

### 5.4.2 Single Chemical Toxicity Data for Herbivorous and Vermivorous Wildlife (Individuals)

Exposure to endpoint species to chemicals found in concentrations greater than background were calculated. The total contaminant exposure estimates for herbivores and vermivores foraging on vegetation or earthworms within an OU were compared to estimated NOAELs to determine if adverse effects are possible. The comparison of estimated exposure and the NOAEL acts as a screening tool to identify COPECs which will be further evaluated for possible estimated effects. LOAELs are then compared to the exposure estimate. If the LOAEL is lower than the exposure, then portions of the endpoint population may experience contaminant exposures that are likely to produce adverse effects. Consequently, the *individuals* living within the OU are at risk due to hazardous exposures.

#### 5.4.2.1 Screening point estimates of exposure

To determine if the contaminant exposures experienced by vermivores and herbivores feeding on each OU are potentially hazardous, the total exposure estimates were compared to estimated NOAELs. Hazard quotients (HQs) were calculated to quantify the magnitude of the hazard where: HQ = estimated contaminant exposure (mg/kg/d)/NOAEL. Hazard quotients greater than one indicate that individuals may be experiencing exposures that are in excess of NOAELs, and may suggest that adverse effects may be occurring. Hazard quotients for all endpoints are presented along with exposure estimates in Tables G.10 to G.13.

The spatial distribution of contamination and potential risks to each endpoint within each OU are illustrated in Figs. G.2 through G.5. These figures display the sum of the NOAEL-based HQs (e.g., sum of toxic units or ∑TUs) for many contaminants which play a role in the cumulative risk within each OU. Importance of contaminants was determined based on the magnitude of the hazard quotients. Although, there are a large number of contaminants contributing small levels to overall risk, the figures display few contaminants contributing to the high levels of risk for each endpoint species.

The ∑TUs for white-tailed deer (Fig. G.2) at LEFPC, K-1407, K-1420, BCOU 2, BCOU1, and UEFPC OU2 range from 132 to 305 with cadmium, mercury, or aluminum responsible for the major contribution of risk. Deer at WAG 1 and WAG 6 are primarily at risk from cadmium with a ∑TUs of 56 and 58, respectively. Chestnut Ridge OU2 and SCF has the highest level of risk associated with the site, with ∑TUs of 348 and 633, respectively. The primary contaminants at SCF are aluminum, cadmium, acetone, and methylene chloride; while cadmium, selenium and thallium contribute the most risk at Chestnut Ridge OU2.

Mercury is the only major contaminant which poses a risk to wild turkey on BCVOU1, LEFPC and BCOU2 (Fig. G.3). In contrast, Fig. G.4 displays short-tailed shrews at significant risk foraging at all OUs, with the exception of WAG 5. The ∑TUs for most OUs ranged from

1256 to 4747; where cadmium, mercury, PCBs, selenium, or aluminum contributed to the majority of the risk. Cadmium at WAG 6 was 368 times the NOAEL benchmark; while risk at WAG 5 is relatively low having $\sum$TUs less than 30.

American woodcock (Fig. G.5) at BCOU1, LEFPC and BCOU2 may experience the highest magnitude of risk relative to other OUs, with $\sum$TUs ranging from 12,875 to 30,776 predominantly due to mercury exposure. Additionally, woodcock foraging at K-1407, WAG 1, SCF, and K-1420 are at risk from mercury contamination ($\sum$TUs = 25,000, 900, 447, and 303, respectively). Woodcock foraging within UEFPC OU2 ($\sum$TU = 146) and WAG 6 ($\sum$TU = 6) are at relatively lower risk compared to other OUs.

To determine if there is a potential for occurrence of adverse effects to the individuals foraging within each OU estimated contaminant exposures experienced by each endpoint were compared to LOAELs (Tables G.16 to G.19). The contaminants at each site which may adversely impact the individual endpoints foraging within each OU are listed below. The magnitude of risk from each contaminant at the site can be evaluated from the LOAEL hazard quotient in parentheses.

With the exception of all endpoints foraging within K-1414 and herbivores at WAG 5, *individuals* of all endpoint species may experience adverse effects at all OUs from incidental ingestion of soil and consumption of vegetation or earthworms. The following is a summary of the primary COPECs for wildlife for each OU:

- **Bear Creek OU1.** Primary COPECs include cadmium, mercury, PCBs and copper. Additional COPECs for short-tailed shrew or American woodcock include arsenic, barium, lead, and zinc.

- **Lower East Fork Poplar Creek.** Primary COPECs for endpoints include cadmium and mercury. Additionally, selenium, PCBs, and zinc were COPECs for vermivorous wildlife.

- **K-1407.** Primary COPECs for endpoints include: aluminum, cadmium (white-tailed deer only), mercury, and selenium (American woodcock and short-tailed shrew only). Additionally, arsenic, uranium and zinc are COPECs for short-tailed shrews or American woodcock.

- **WAG 1.** The primary COPECs include cadmium (for all endpoints), mercury, and selenium (vermivores only). Additionally, arsenic, PCBs, thallium, and zinc are COPECs for shrews or woodcock.

- **WAG 5.** Vermivores foraging within WAG 5 may experience adverse effects from incidental ingestion of soil and consumption of earthworms. Mercury and zinc are the primary contaminants of concern. Herbivorous wildlife are not at risk on WAG 5.

- **WAG 6.** The primary COPEC is cadmium. Additionally, mercury is a COPEC for the American woodcock.

Table 5.1. COPECs for each endpoint species foraging within each OU (LOAEL HQs in parentheses)

| OUs | White-tailed deer | Wild turkey | Short-tailed shrew | American woodcock |
|---|---|---|---|---|
| BCVOU1 | Cadmium (109.9)<br>Copper (5.9)<br>Mercury (5.3) | Mercury (6.3) | Arsenic (3.9)<br>Cadmium (1136.9)<br>Copper (2.3)<br>Mercury (250.4)<br>Total PCBs[a] (61.8)<br>Zinc (4.3) | Barium (1.6)<br>Cadmium (1.1)<br>Copper (1.6)<br>Lead (4.3)<br>Mercury (1299.3)<br>Total PCBs (16.7)<br>Zinc (17.6) |
| LEFPC | Cadmium (47.6)<br>Mercury (7) | Mercury (8.2) | Arsenic (2.3)<br>Cadmium (491.8)<br>Mercury (327.2)<br>Total PCBs (4.6)<br>Selenium (41.1) | Mercury (1697.8)<br>Selenium (29.2)<br>Zinc (2.6) |
| K-1407 OU | Aluminum (13.3)<br>Cadmium (22)<br>Mercury (1.1) | Aluminum (7.8)<br>Mercury (1.3) | Aluminum (114.7)<br>Arsenic (3.8)<br>Mercury (50.3)<br>Selenium (33.7)<br>Uranium (2.7) | Aluminum (89.5)<br>Mercury (261)<br>Selenium (24)<br>Zinc (1) |
| WAG 1 | Cadmium (20.1) | | Arsenic (2.8)<br>Cadmium (207.7)<br>Mercury (14.5)<br>Total PCBs (4.4)<br>Selenium (79.4)<br>Thallium (5.8) | Mercury (75.5)<br>Selenium (56.4)<br>Zinc (1.6) |
| WAG 5 | | | Mercury (1.8) | Mercury (9.3)<br>Zinc (2.7) |
| WAG 6 | Cadmium (29.1) | | Cadmium (301.3) | |

## Table 5.1 (continued)

| OUs | White-tailed deer | Wild turkey | Short-tailed shrew | American woodcock |
|---|---|---|---|---|
| UEFPC OU2 | Aluminum (30.2) | Aluminum (17.6) | Aluminum (260.5)<br>Barium (1.3)<br>Zinc (1.1) | Aluminum (203.3)<br>Barium (2.2)<br>Lead (2)<br>Zinc (4.5) |
| BC OU2 | Aluminum (16.6)<br>Cadmium (8.8)<br>Mercury (12.7) | Aluminum (9.7)<br>Mercury (15) | Aluminum (143.4)<br>Arsenic (10.2)<br>Cadmium (90.8)<br>Mercury (598)<br>Selenium (8.4) | Aluminum (111.9)<br>Lead (1)<br>Mercury (3103.4)<br>Selenium (6)<br>Zinc (2.3) |
| SCF | Acetone (38.9)<br>Aluminum (9.5)<br>Cadmium (75.9)<br>Methylene Chloride (6.6) | 1,2-Dichloroethane (1.2)<br>Aluminum (5.5) | Aluminum (82)<br>Arsenic (4.2)<br>Cadmium (785)<br>Mercury (6.7)<br>Selenium (14) | Mercury (34.9)<br>Selenium (9.9)<br>Zinc (2.3) |
| K-1420 OU | Aluminum (22.8) | Aluminum (13.3) | Aluminum (196.9)<br>Mercury (3.4)<br>PCB-1254 (11.1)<br>Uranium (2.9)<br>Vanadium (2) | Aluminum (153.6)<br>Mercury (17.6)<br>PCB-1254 (3)<br>Zinc (2.4) |
| Chestnut Ridge OU2 | Aluminum (8.3)<br>Arsenic (1.3)<br>Cadmium (17.8)<br>Selenium (11.6)<br>Thallium (2.2) | Aluminum (5.9) | No earthworms are present at the site because fly ash is unsuitable to support earthworms. Therefore, exposure was not calculated for vermivorous wildlife. | |

[a]Total PCBs = sum of PCB-1254 and 1260.

- **Upper East Fork Poplar Creek OU2.** The primary COPEC is aluminum which exceeds background levels by 3.5 times. Additionally, barium, lead and zinc are COPECs for shrews or woodcock.

- **Bear Creek OU2.** The primary COPECs are aluminum, cadmium, and mercury. Additionally, arsenic, lead, selenium, and zinc are COPECs for shrews or woodcock.

- **South Campus Facility.** The primary COPECs are aluminum, acetone (herbivores only), cadmium, mercury, and selenium (vermivores only). Additionally, arsenic, 1,2-dichloroethane, methylene chloride, and zinc are COPECs for deer, turkey, shrews, or woodcock.

- **K-1420.** The primary COPEC for all endpoints is aluminum. Additional COPECs include: mercury, PCBs, uranium, vanadium and zinc (shrews or woodcock).

- **Chestnut Ridge OU2.** Herbivores may experience adverse effects from ingestion of vegetation and soil. Earthworms are absent from the site (ash is unsuitable for earthworms); therefore vermivorous wildlife are not at risk due to lack of exposure pathway. Primary contaminants of concern for herbivores include aluminum, arsenic, cadmium, and selenium. White-tailed deer may also be at risk from thallium.

- **K-1414.** Herbivores and vermivores are not at risk from contaminant exposure within this OU.

### 5.4.3 Effects of Retained Contaminants for Herbivorous and Vermivorous Wildlife

#### 5.4.3.1 Acetone

Both the NOAEL and LOAEL for mammalian endpoints are based on a study in which liver and kidney damage was observed in rats fed acetone for 90 days (EPA 1986). Three dose levels were administered (100, 500, and 2500 mg/kg/d). Significant tubular degeneration of the kidneys and increases in kidney weights were observed at the 500 mg/kg/d dose level. No adverse effects were observed at the 100 mg/kg/d level. These doses are considered subchronic values and therefore were multiplied by the subchronic-chronic uncertainty factor of 0.1. Based on the results of EPA (1986), white-tailed deer foraging at South Campus Facility experiencing exposure ≥LOAEL may display tubular degeneration of the kidneys.

Although acetone is highly volatile, the exposure experienced by white-tailed deer is 184 times the LOAEL. The presence of acetone may be a concern if it is a continuous source.

#### 5.4.3.2 Aluminum

Both the NOAEL and LOAEL for mammalian endpoints are based on a study in which reproductive success and offspring survival was observed among mice fed aluminum chloride for three generations (Ondreicka et al. 1966). One dose level (19.3 mg/kg/d) was administered and resulted in significant reduction of growth within generations 2 and 3. There was no effect on litter size or the number of litters. Therefore, this dose was designated as the chronic LOAEL. The chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results obtained by Ondreicka et al. (1966) eastern cottontails, white-tailed deer, and short-tailed shrews foraging at all OUs may experience a reduction in growth.

The NOAEL for avian endpoints is based on a study in which the reproductive success of ringed doves was observed for over 4 months, which included a critical life stage (Carriere et al. 1986). One dose (109.7 mg/kg/d) was administered over this time and was designated as the NOAEL since no adverse effects were observed. The LOAEL is based on a study in which mortality was observed among 1 day-old white leghorn chicks (Storer and Nelson 1968). Of four doses administered within a 2-week duration, the highest dosage (445 mg/kg/d) resulted in 25 % mortality. Since the study considered exposure for only 2 weeks, excluding critical life stages, this dose was considered to be a subchronic LOAEL. A chronic LOAEL was estimated by multiplying the subchronic LOAEL by a subchronic-chronic uncertainty factor of 0.1 (LOAEL = 44.5 mg/kg/d). Based on the results obtained by Storer and Nelson (1968), wild turkeys and American woodcock foraging within all OUs may experience increased mortality.

Although aluminum exceeds ecotoxicological benchmarks, Al is found at high levels within all OUs and only exceeds ORR background levels within Upper East Fork Poplar Creek OU2, Bear Creek OU2, South Campus Facility, K-1420, and K-1407. The measured soil concentrations are likely much higher than levels which are bioavailable to the endpoint species due to the acid digestion procedures employed. Additionally, the predominant forms of aluminum within the OU soil and the form used in toxicity tests are likely different. Therefore, the levels of aluminum which demonstrated adverse effects may not be comparable to levels found on the OU due to form and bioavailability.

### 5.4.3.3 Arsenic

Both the NOAEL and LOAEL for mammalian endpoints are based upon a study in which reproductive success and offspring survival was observed among mice fed arsenite for three generations (Schroeder and Mitchner 1971). One dose level administered (1.261 mg/kg/d), designated as the chronic LOAEL, resulted in declining litter size with each successive generation. A chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL correction factor of 0.1. Based on the results of Schroeder and Mitchner (1971), short-tailed shrews foraging within most of the OUs experiencing exposures ≥LOAEL are likely to display a decline in litter size.

### 5.4.3.4 Barium

The NOAELs for mammals are based on a study in which growth, food and water consumption, and hypertension was observed among rats fed barium chloride for 16 months (Perry et al. 1983). Three dose levels were administered. The maximum dose (5.1 mg/kg/d) did not affect growth, food or water consumption and was therefore considered to be a chronic NOAEL. The LOAEL was based on a study which observed mortality in rats fed barium for 10 days (Borzelleca et al. 1988). Four doses were administered and exposure of rats to the highest dose (300 mg/kg/d) resulted in 30% mortality to female rats. The 300 mg/kg/d dose is considered to be a subchronic LOAEL; therefore a chronic LOAEL was estimated by multiplying the subchronic LOAEL by a subchronic to chronic uncertainty factor of 0.1. Based on the results of Borzelleca et al. (1988), short-tailed shrews experiencing exposures ≥LOAEL may display increased mortality.

Both the NOAELs and LOAELs for woodcock and turkeys are based on a study which observed mortality to 1-day old chicks fed eight doses of barium hydroxide for 4 weeks (Johnson et al. 1960). The NOAEL dosage (208.3 mg/kg/d) produced no mortality; while the LOAEL dosage (416.5 mg/kg) and highest dosage (40.3 mg/kg/d) resulted in 5% to 100% mortality. The NOAEL and

LOAEL were considered subchronic and was multiplied by the subchronic to chronic uncertainty factor of 0.1. Based on the results of Johnson et al. (1960), American woodcock at Bear Creek OU1 and Upper East Fork OU2 experiencing exposures ≥LOAEL may display increased mortality.

#### 5.4.3.5 Cadmium

Both the NOAEL and LOAEL for mammalian endpoints are based upon a study in which reproductive success was observed among rats fed cadmium chloride for four generations (Wills et al. 1981). Three dose levels were administered. The highest dose (.01 mg/kg/d), designated as the chronic LOAEL, resulted in a reduction in fertility. The number of litters/ number of females was reduced by 63% in rats. Fertility was not reduced at the lower dosage (.008 mg/kg/d) which was designated as the chronic NOAEL. Based on the results of Wills et al. (1981), white-tailed deer and short-tailed shrews experiencing exposure ≥LOAEL may display reduced fertility.

Both the NOAEL and LOAEL for avian endpoints are based upon a study in which reproductive success was observed among mallard ducks fed cadmium chloride for 90 days (White and Finley 1978). Three dose levels were administered. The highest dosage (20.03 mg/kg/d), designated as the chronic LOAEL, produced significantly fewer eggs. A dosage of 1.45 mg/kg/d produced no adverse effects and was designated as the chronic NOAEL. Based on results of White and Finley (1978), American woodcock experiencing exposures ≥LOAEL at Bear Creek OU 1 may display impaired reproduction.

#### 5.4.3.6 Copper

Both the NOAEL and LOAEL for mammalian endpoints are based on a study in which mink were fed copper sulfate for 357 days (including a critical life stage) (Aulerich et al. 1982). While consumption of 15.14 mg/kg/d copper increased the percentage of mortality in mink kits, no adverse effects were observed at a 11.71 mg/kg/d exposure level. Based on the results of Aulerich et al. (1982), white-tailed deer and short-tailed shrews experiencing exposures ≥LOAEL within Bear Creek OU1 may display a reduction in offspring survival.

Both the NOAEL and LOAEL for avian endpoints are based on a study in which 1 day old chicks were fed copper oxide for 10 weeks (Mehring et al. 1960). Eleven dose levels were administered in the study. No adverse effects were observed on the growth of chicks up to dose levels of 47 mg/kg/d. Consumption of 61.7 mg/kg/d copper in the diet, designated as the LOAEL, resulted in reduced growth by over 30% and produced 15 % mortality. Based on results of Mehring et al. (1960), American woodcock experiencing exposures ≥LOAEL at Bear Creek OU1 may display a reduction in growth and survivorship.

#### 5.4.3.7 1,2-Dichloroethane

Both the wild turkey NOAEL and LOAEL are based on a study in which chickens were fed two levels of 1,2-dichloroethane for 2 years (Alumot et al. 1976b). Egg production was reduced at a level of 34.4 mg/kg/d, which was designated as the chronic LOAEL. No adverse effects were observed at an exposure of 17.2 mg/kg/d. Based on results of Alumot et al. (1976b), wild turkeys experiencing exposures ≥LOAEL at South Campus Facility may display reduced egg production.

#### 5.4.3.8 Mercury

Both the NOAEL and LOAEL for mammalian endpoints are based upon a study in which reproductive success and offspring survival was observed among rats fed methyl mercury for three generations (Verschuuren et al. 1976c). The highest dose administered (0.16 mg/kg/d), designated as the LOAEL, resulted in reduction in offspring viability. This exposure also resulted in reduction in growth, increased kidney weight, and altered kidney histochemistry (Verschuuren et al. 1976b). No effects were observed at a dose of 0.032 mg/kg/d. The study was considered to represent chronic exposure; therefore, a subchronic-chronic correction factor was not employed. Based on the results of Verschuuren et al (1976 a,b,c), white-tailed deer and short-tailed shrews experiencing exposure ≥LOAELs are likely to display impaired reproduction.

Both the wild turkey and American woodcock NOAELs and LOAELs are based on a study in which reproductive success was observed among mallard ducks which were fed methyl mercury for three generations (Heinz 1979). The study was considered to represent a chronic exposure. The only dose level administered, 0.064 mg/kg/d, caused hens to lay fewer eggs, lay more eggs outside the nest box, and produce fewer ducklings. This dose level was considered the chronic LOAEL. Because an experimental NOAEL was not established, the chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of Heinz (1979), wild turkeys and American woodcock experiencing exposures ≥LOAELs may display impaired reproduction.

#### 5.4.3.9 Methylene chloride

The NOAEL and LOAEL for the mammalian endpoints was based on a study in which rats were fed methylene chloride for 2 years (NCA 1982). Rats fed a 5.85 mg/kg/d dose level did not experience adverse effects and is considered the chronic NOAEL. Rats consuming 50 mg/kg/d or greater produced histological changes in the liver. This dose level was designated as the chronic LOAEL. Based on results of the NCA (1982), white-tailed deer experiencing exposures ≥LOAELs at South Campus Facility may display changes in liver histology.

#### 5.4.3.10 PCBs

The short-tailed shrew NOAEL and LOAEL are based on a study in which oldfield mice were fed Aroclor-1254 for 12 months (McCoy et al. 1995). A dose level of 0.68 mg/kg/d, designated as the chronic LOAEL, caused a reduction in the number of litters, offspring weights, and offspring survival. Because an experimental NOAEL was not established, the chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of McCoy et al. (1995), short-tailed shrews experiencing exposures ≥ the LOAEL may display impaired reproduction and offspring viability.

The American woodcock NOAEL and LOAEL are based on a study in which ring-necked pheasants were fed Aroclor-1254 for 17 weeks (Dahlgren et al. 1972). A dose level of 1.8 mg/kg/d, designated as the chronic LOAEL, caused a significant reduction in egg hatchability. Because an experimental NOAEL was not established, the chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of Dahlgren et al. (1972), American woodcock experiencing exposures ≥ the LOAEL may display a reduction in egg hatchability.

#### 5.4.3.11 Selenium

The short-tailed shrew NOAEL and LOAEL are based on a study in which selenate was fed to mice for 3 generations (Schroeder and Mitchner 1971). An administered dose level of 0.76 mg/kg/d, designated as the chronic LOAEL, caused reduced reproductive success with a high incidence of runts and failure to breed. Because an experimental NOAEL was not established, the chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of Schroeder and Mitchner (1971), short-tailed shrews experiencing exposures ≥ the LOAEL may display a reduction in reproductive success.

The American woodcock NOAEL and LOAEL are based on a study in which mallard ducks were fed sodium selenite for 78 days (Heinz et al. 1987). Reproductive success was observed at four dose levels. A dose of 0.5 mg/kg/d produced no adverse effects and was therefore considered the chronic NOAEL. A dose as low as 1 mg/kg/d selenium in the diet resulted in a significantly larger frequency of lethally deformed embryos compared to 0.5 mg/kg/d dose level. Consumption of 2.5 mg/kg/d caused a reduction of duckling survival, while 10 mg/kg/d reduced adult survival. Since adverse effects were observed at exposures as low as 1 mg/kg/d, this level was considered the chronic LOAEL. Based on the results of Heinz et al. (1987), American woodcock experiencing exposures ≥LOAEL may display a reduction in offspring viability.

#### 5.4.3.12 Thallium

The short-tailed shrew NOAEL and LOAEL are based on a study in which rats were fed thallium sulfate for 60 days (Formigli et al. 1986). This study represents subchronic exposures since the duration of the study did not include a critical life stage. Rats exposed to a single dose, 0.074 mg/kg/d, displayed reduced sperm motility. Since this is a subchronic exposure, a subchronic-chronic uncertainty factor of 0.1 was applied to obtain a chronic LOAEL. To estimate the chronic NOAEL, the chronic LOAEL was multiplied by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of Formigli et al. (1986), short-tailed shrews experiencing exposures ≥ the LOAEL may display impaired reproduction from a reduction of sperm motility.

#### 5.4.3.13 Uranium

The short-tailed shrew NOAEL and LOAEL are based on a study in which mice were fed uranyl acetate for 60 days prior to gestation, through gestation, delivery and lactation (Paternain et al. 1989). This study represents chronic exposures since it took place during the critical life stage of the mouse. Significant effects on reproduction including increased number dead young/litter and reduction in size and weight of offspring were observed at 6.13 mg/kg/d. The lowest dose administered, 3.07 mg/kg/d, resulted in no significant differences in measured reproductive parameters. Therefore, these doses were considered the chronic LOAEL and NOAEL, respectively. Based on the results of Paternain et al. (1989), short-tailed shrews experiencing exposures ≥ the LOAEL may display a reduction in reproductive success.

#### 5.4.3.14 Vanadium

The short-tailed shrew NOAEL and LOAEL are based on a study in which rats were fed sodium metavanadate for 60 days prior to gestation, through gestation, delivery and lactation (Domingo et al. 1986). This study represents chronic exposures since it took place during the rat's critical life stage. Significant effects on reproduction including increased number dead young/litter and reduction in size and weight of offspring were observed at the lowest dose administered, 5 mg/kg/d. Therefore, this dose was considered the chronic LOAEL. To estimate the chronic NOAEL, the chronic LOAEL was multiplied by a LOAEL-NOAEL uncertainty factor of 0.1. Based on the results of Domingo et al. (1986), short-tailed shrews experiencing exposures ≥ the LOAEL may display a reduction in reproductive success.

### 5.4.4 Population Level Risks on the Oak Ridge Reservation

The COPECs within each OU, as designated by the screening process (Sect. 5.4.1), may cause adverse effects (Sect. 5.4.2) to *individuals* foraging within each OU. To consider adverse effects on the reservation-wide *population*, steps 3 through 6 within the problem formulation (Sect. 5.1) must be completed. By comparing an endpoint species habitat requirements (Table B.1), the amount of suitable habitat within each OU (Table B.3), and population densities for each endpoint (see below), the number of individuals exposed on an OU can be estimated. The densities used for each endpoint species are presented in the following table.

| | White-tailed deer | Wild turkey | Short-tailed shrew | American woodcock |
|---|---|---|---|---|
| Density | 0.1704[a] | 0.0426[a] | 23/ha (median of 2.5 to 45/ha range) | .28/ha (based on 5.6 males/100 ha; assuming 1:1 sex ratio) |
| No. on the ORR (if known) | 2000 | >500 | | |
| Source | Personal communication, Jim Evans | Personal communication, Jim Evans | Getz 1989 | Stewart and Robbins 1958 |

[a]Density calculated based on total deer and turkey habitat on ORR (11,734.8 ha) and total number of deer and turkey estimated on ORR (2000 deer and 500 turkey).

Since contaminants found on all OUs, with the exception of K-1414, present a risk to all assessment endpoints, the number of animals present in the OU is equivalent to the number of individuals exposed at unacceptable levels. The estimated number of individual herbivores and vermivores exposed within each OU and the proportion of the reservation-wide population that are at risk are summarized in Tables 5.2 through 5.5.

**Table 5.2. The number of potentially exposed white-tailed deer within each OU and the entire reservation**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[ab] | % of the ORR population exposed[c] |
|---|---|---|---|---|
| LEFPC | Evergreen plantation (2.62)<br>Evergreen forest (7.37)<br>Deciduous forest (41.06)<br>Mixed forest (50.87)<br>Pasture (8.5)<br>Transitional (133.87) | 244.29 | 42 | 2.1 |
| BCVOU1 | Deciduous forest (8.19)<br>Mixed forest (0.25)<br>Pasture (9.19)<br>Transitional (24) | 41.6 | 7 | 0.4 |
| WAG 5 | Deciduous forest (3.56)<br>Mixed forest (6.44)<br>Pasture (7.69)<br>Transitional (9.06) | 26.75 | 5 | 0.25 |
| South Campus Facility | Pasture (13.25)<br>Transitional (4.5) | 17.75 | 3 | 0.15 |
| WAG 6 | Deciduous forest (5.06)<br>Mixed forest (2.06)<br>Pasture (0.5)<br>Transitional (2.94) | 10.56 | 2 | 0.10 |
| Chestnut Ridge OU2 | Deciduous forest (3.81)<br>Mixed forest (0.38)<br>Transitional (2.62) | 6.81 | 1 | 0.05 |
| WAG 1 | Evergreen forest (0.81)<br>Deciduous forest (1.25)<br>Mixed forest (0.81)<br>Pasture (0.94) | 3.81 | .7 | 0.04 |
| K-1407 OU | Transitional (4.19) | 4.19 | 0.7 | 0.04 |
| BC OU2 | Transitional (0.62) | 0.62 | 0.1 | 0.005 |
| UEFPC OU2 | 0 | 0 | 0 | 0.00 |
| K-1420 OU | 0 | 0 | 0 | 0.00 |
| K-1414 OU[d] | | | | |

**Table 5.2 (continued)**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[ab] | % of the ORR population exposed |
|---|---|---|---|---|
| Total no. exposed within 12 OUs | | | 62[b] | |
| Total reservation | Evergreen plantations (323.5)<br>Evergreen forest (704.87)<br>Deciduous forest (4,028.62)<br>Mixed forest (3,469)<br>Pasture (312.44)<br>Transitional (2,896.19) | 11,734.8 | 2000[e] | |
| Percentage of the ORR population at risk | | | | **3.1%** |

[a]The number of animals present within OU was calculated by multiplying the total area of suitable habitat (ha) by 0.1704 deer/ha (calculated from 2,000 deer on reservation).

[b]All white-tailed deer present on OUs are exposed at contaminant levels >LOAELs, with the exception of animals at WAG 5 and K-1414.

[c]The percentage of theORR population exposed = (estimated no. of animals present on the OU/the total no. of animals on the reservation) x 100.

[d]Habitat maps are not available for the K-1414 OU.

[e]The approximately 2,000 deer present on the ORR were estimated from deer hunts (personal communication, Jim Evans 1995).

**Table 5.3. The number of potentially exposed wild turkey within each OU and the entire reservation**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[ab] | % of ORR population exposed[c] |
|---|---|---|---|---|
| LEFPC | Evergreen plantation (2.62)<br>Evergreen forest (7.37)<br>Deciduous forest (41.06)<br>Mixed forest (50.87)<br>Pasture (8.5)<br>Transitional (133.87) | 244.29 | 10 | 2.0 |
| BCVOU1 | Deciduous forest (8.19)<br>Mixed forest (0.25)<br>Pasture (9.19)<br>Transitional (24) | 41.6 | 2 | 0.4 |
| WAG 5 | Deciduous forest (3.56)<br>Mixed forest (6.44)<br>Pasture (7.69)<br>Transitional (9.06) | 26.75 | 1 | 0.2 |

**Table 5.3 (continued)**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[a,b] | % of ORR population exposed[c] |
|---|---|---|---|---|
| South Campus Facility | Pasture (13.25)<br>Transitional (4.5) | 17.75 | 0.8 | 0.16 |
| WAG 6 | Deciduous forest (5.06)<br>Mixed forest (2.06)<br>Pasture (0.5)<br>Transitional (2.94) | 10.56 | 0.5 | 0.10 |
| Chestnut Ridge OU2 | Deciduous forest (3.81)<br>Mixed forest (0.38)<br>Transitional (2.62) | 6.81 | 0.3 | 0.06 |
| WAG 1 | Evergreen forest (0.81)<br>Deciduous forest (1.25)<br>Mixed forest (0.81)<br>Pasture (0.94) | 3.81 | 0.2 | 0.00 |
| K-1407 OU | Transitional (4.19) | 4.19 | 0.2 | 0.04 |
| BC OU2 | Transitional (0.62) | 0.62 | 0.03 | 0.006 |
| UEFPC OU2 | 0 | 0 | 0 | 0.00 |
| K-1420 OU | 0 | 0 | 0 | 0.00 |
| K-1414 OU[d] | | | | |
| Total no. exposed within 12 OUs | | | 15[b] | |
| Total reservation | Evergreen plantations (323.5)<br>Evergreen forest (704.87)<br>Deciduous forest (4,028.62)<br>Mixed forest (3,469)<br>Pasture (312.44)<br>Transitional (2,896.19) | 11,734.8 | 500[e] | |
| Percentage of ORR population at risk | | | | **3.01%** |

[a]The number of animals present within the OU was calculated by multiplying the total area of suitable habitat (ha) by 0.0426 wild turkey/ha (calculated from 500 turkey observed on the reservation).

[b]All wild turkey present on OUs are exposed at contaminant levels >LOAELs, with the exception of animals at WAG 1, WAG 5, and K-1414.

[c]The percentage of the ORR population exposed = (estimated no. of animals present on the OU/total no. of animals on the reservation) x 100.

[d]Habitat maps are not available for the K-1414 OU.

[e]Approximately 500 wild turkey are present on the ORR (personal communication, Jim Evans 1995).

**Table 5.4. The number of potentially exposed short-tailed shrews within each OU and the entire reservation**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present [a,b] | % of the ORR population exposed[c] |
|---|---|---|---|---|
| LEFPC | Evergreen plantation (2.62)<br>Evergreen forest (7.37)<br>Deciduous forest (41.06)<br>Mixed forest (50.87)<br>Transitional (133.87) | 235.79 | 5,423 | 2.06 |
| BCVOU1 | Deciduous forest (8.19)<br>Mixed forest (0.25)<br>Transitional (24) | 32.41 | 745 | 0.28 |
| WAG 5 | Deciduous forest (3.56)<br>Mixed forest (6.44)<br>Transitional (9.06) | 19.06 | 438 | 0.17 |
| WAG 6 | Deciduous forest (5.06)<br>Mixed forest (2.06)<br>Transitional (2.94) | 10.06 | 231 | 0.09 |
| Chestnut Ridge OU2 | Deciduous forest (3.81)<br>Mixed forest (0.38)<br>Transitional (2.62) | 6.81 | 157 | 0.06 |
| South Campus Facility | Transitional (4.5) | 4.5 | 104 | 0.04 |
| K-1407 OU | Transitional (4.19) | 4.19 | 96 | 0.04 |
| WAG 1 | Evergreen forest (0.81)<br>Deciduous forest (1.25)<br>Mixed forest (0.81) | 2.87 | 66 | 0.03 |
| BC OU2 | Transitional (0.62) | 0.62 | 14 | 0.005 |
| UEFPC OU2 | 0 | 0 | 0 | 0.00 |
| K-1420 OU | 0 | 0 | 0 | 0.00 |
| K-1414 OU[d] | | | | |
| Total no. exposed within 12 OUs | | | 7,274[b] | |
| Total reservation | Evergreen plantations (323.5)<br>Evergreen forest (704.87)<br>Deciduous forest (4,028.62)<br>Mixed forest (3,469)<br>Transitional (2,896.19) | 11,422.36 | 262,714 | |

**Table 5.4 (continued)**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present [a,b] | % of the ORR population exposed[c] |
|---|---|---|---|---|
| Percentage of ORR population at Risk | | | | **2.78%** |

[a]The number of animals present within the OU was calculated by multiplying the total area of suitable habitat (ha) by 23 short-tailed shrews/ha (Getz 1989, as cited in EPA 1987).
[b]All animals present within OUs are exposed at levels exceeding LOAELs, with the exception of animals at K-1414.
[c]The percentage of the ORR population exposed = (estimated no. of animals present on the OU/total no. of animals on the reservation) x 100.
[d]Habitat maps are not available for the K-1414 OU.

**Table 5.5. The number of potentially exposed American woodcock within each OU and the entire reservation**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[a,b] | % of the ORR population exposed[c] |
|---|---|---|---|---|
| LEFPC | Deciduous forest (41.06)<br>Mixed forest (50.87)<br>Pasture (8.5)<br>Transitional (133.87) | 234.3 | 66 | 2.2 |
| BCVOU1 | Deciduous forest (8.19)<br>Mixed forest (0.25)<br>Pasture (9.19)<br>Transitional (24) | 41.6 | 12 | 0.4 |
| WAG 5 | Deciduous forest (3.56)<br>Mixed forest (6.44)<br>Pasture (7.69)<br>Transitional (9.06) | 26.75 | 8 | 0.27 |
| South Campus Facility | Pasture (13.25)<br>Transitional (4.5) | 17.75 | 5 | 0.17 |
| WAG 6 | Deciduous forest (5.06)<br>Mixed forest (2.06)<br>Pasture (0.5)<br>Transitional (2.94) | 10.56 | 3 | 0.10 |
| Chestnut Ridge OU2 | Deciduous forest (3.81)<br>Mixed forest (0.38)<br>Transitional (2.62) | 6.81 | 2 | 0.07 |
| WAG 1 | Deciduous forest (1.25)<br>Mixed forest (0.81)<br>Pasture (0.94) | 3 | 0.8 | 0.03 |

**Table 5.5 (continued)**

| OU | Available habitat (ha) | Total suitable area (ha) | No. of animals present[ab] | % of the ORR population exposed[c] |
|---|---|---|---|---|
| K-1407 OU | Transitional (4.19) | 4.19 | 1 | 0.03 |
| BC OU2 | Transitional (0.62) | 0.62 | 0.2 | 0.007 |
| UEFPC OU2 | 0 | 0 | 0 | 0.00 |
| K-1420 OU | 0 | 0 | 0 | 0.00 |
| K-1414 OU[d] | | | | |
| Total no. exposed within 12 OUs | | | 98 | |
| Total reservation | Deciduous Forest (4,028.62)<br>Mixed Forest (3,469)<br>Pasture (312.44)<br>Transitional (2,896.19) | 10,706.25 | 2,998 | |
| Percentage of the ORR population at risk | | | | **3.27%** |

[a]The number of animals present within the OU was calculated by multiplying the total area of suitable habitat (ha) by 0.28 American woodcock/ha (derived from Stewart and Robbins 1958).

[b]All woodcock present within OUs are exposed at levels exceeding the LOAEL, with the exception of animals at K-1414.

[c]The percentage of the ORR population exposed = (estimated no. of animals present on the OU/total no. of animals on the reservation) x 100.

[d]Habitat maps are not available for the K-1414 OU.

Although specific OUs pose unacceptable risks to the individuals, the total number of exposed individuals within the entire ORR population is minimal. Approximately 3% and 3.1% of the reservation-wide populations of turkey and deer are at risk. Only 2.78% and 3.27% of short-tailed shrews and woodcock on the ORR are at risk. Therefore, using the 20% criterion outlined by Suter et al. (1994a), the occurrence of population-level effects on the reservation are highly unlikely. However, since the short-tailed shrew is a measurement endpoint for four species of T&E shrews, 2.78% of the impacted population may represent a significant risk to the reservation-wide populations of these T&E species.

Approximately 2.78% to 3.27% of the remaining assessment endpoint populations are experiencing contaminant exposures in excess of LOAELs and may be adversely impacted. Lower East Fork Poplar Creek OU contributed, by far, the highest number of deer, shrews, woodcock, and turkeys at risk on the ORR. Contaminants of concern at Lower East Fork Poplar Creek include mercury, cadmium, and aluminum. Bear Creek OU1 ranks as the number two contributor of exposed animals within the ORR populations. Cadmium, aluminum, copper, and mercury are of concern at Bear Creek OU1. Additionally, WAG 5 the third ranked contributor, only poses a risk to the short-tailed shrew and woodcock populations from mercury and zinc exposure.

### 5.4.5 Quality and Completeness of Data

While the data used in this portion of the assessment were generally considered to be of high quality, spatial coverage of the ORR was incomplete. Soil data were only available for 12 of 37 OUs on the ORR. Consequently, the magnitude of risk to reservation-wide populations is underestimated. The actual magnitude cannot be determined without incorporating data from additional OUs.

Another limitation, discussed in Chap. 4, concerns the level of detail in the ORR habitat map. There is a need for the habitat maps to identify specific characteristics of the habitat categories. For example, identification of floodplain forests, dense forests, etc. is necessary to better determine suitable habitat for many endpoint species. Furthermore, a better estimation of the number of individuals of each endpoint species within each OU may be predicted.

Additionally, the lack of site specific vegetation and earthworm concentrations on many OUs result in the use of average calculated soil-plant or soil-earthworm uptake factors. The uptake factors have a high degree of uncertainty associated with them and may over or underestimate the risk to herbivorous or vermivorous wildlife.

### 5.4.6 Uncertainties Concerning Risks to Herbivorous and Vermivorous Wildlife

#### 5.4.6.1 Limitations of habitat maps

The level of precision differs between the habitat maps and the habitat requirements data. For example, habitat type such as open forest, dense forest, or floodplain forest cannot be identified. More detailed information is necessary since the actual habitat which is used may be only portions of the habitat categories (i.e., woodcock prefer moist floodplain soils in forested areas). This may overestimate or underestimate the number of individuals present within an OU.

#### 5.4.6.2 Soil to vegetation and earthworm uptake factors

There is a large degree of uncertainty when using soil to vegetation and earthworm uptake factors to model contaminant concentrations found in vegetation and earthworms. Uptake factors of inorganics will vary by soil condition (i.e., pH, water availability, organic matter content, texture, aeration, elemental concentrations, etc.) and plant/earthworm conditions (species and age) (Sommers et al. 1987; Chaney et al. 1984). Using plant uptake factors assumes that all species and all soil conditions will result in the same uptake rate. Also, using uptake factors assumes that the uptake rate is best estimated by taking the average of all observed values. These site specific factors within the OUs are not taken into consideration for the uptake factors which were used. Therefore, the predicted contaminant concentrations in vegetation and earthworms may be overestimated or underestimated; thus overestimating or underestimating contaminant exposure for each endpoint species.

### 5.4.6.3 Relative quality of habitats

It was assumed that the quality of habitat found within each land cover type was equivalent. Although specific land cover types were designated as providing suitable habitat, the usability of the areas will vary and certain habitat types may be used preferentially. This will either overestimate or underestimate the number of animals found within each OU based on the lower or higher quality of certain habitat types.

### 5.4.6.4 Distribution of contamination within habitats on Operable Units

It was assumed that contamination was equally distributed throughout the OU. Therefore, all available habitat that is used by the specific endpoint was assumed to be equally contaminated throughout the entire OU. Because most contamination is likely to be in less suitable habitats (urban areas, lawns, etc.), on OU contaminant exposure is likely to be overestimated.

### 5.4.6.5 Literature density values

The use of literature density values of endpoint species, with the exception of deer and turkey, obtained from other areas of the United States, are considered representative of the ORR. This may overestimate or underestimate the number of exposed individuals.

### 5.4.6.6 Bioavailability of contaminants

It was assumed that 100% of the contaminant concentrations reported in soil and modeled vegetation and earthworms were bioavailable. The double acid extraction method used to determine soil concentrations reflect the total potential pool of contaminants. The future bioavailability of these contaminants which is dependent upon the chemical (e.g., pH, organic carbon) and physical (e.g., clay, moisture content) nature of the soil can not be addressed for this assessment. Therefore, exposure estimates based upon the contaminant concentrations in media are highly conservative and are likely to overestimate the actual contaminant exposure experienced.

### 5.4.6.7 Extrapolation from published toxicity data

To estimate toxicity of contaminants at the site, it was necessary to extrapolate from NOAELs observed for test species (i.e., rats and mice). While it was assumed that toxicity could be estimated as a function of body size, the accuracy of the estimate is not known. For example, white-tailed deer may be more or less sensitive than rats or mice.

Additional extrapolation uncertainty exists for those contaminants for which data consisted of either LOAELs or was subchronic in duration. For either case, an uncertainty factor of 10 was employed to estimate NOAELs or chronic data. The uncertainty factor of 10 may either over- or underestimate the actual LOAEL-NOAEL or subchronic-chronic relationship.

### 5.4.6.8 Variable food and water consumption

While food consumption by wildlife was assumed to be similar to that reported for the same species in other locations, the validity of this assumption cannot be determined. Food consumption at the Clinch

River and Poplar Creek may be greater or less than that reported in the literature, resulting in either an increase or decrease in contaminant exposure. Similarly, water consumption was estimated according to the allometric equations of Calder and Braun (1983). The accuracy with which the estimated water consumption represents actual water consumption is unknown.

#### 5.4.6.9 Single contaminant tests vs exposure to multiple contaminants in the field

While plants and eastern cottontails are exposed to multiple contaminants concurrently, published toxicological values only consider effects experienced by exposures to single contaminants. Because some contaminants can interact antagonistically, single contaminant studies may overestimate their toxic potential. Similarly, for those contaminants that interact additively or synergistically, single contaminant studies may underestimate their toxic potential.

#### 5.4.6.10 Inorganic constituents or species present in the environment

Toxicity of metal species varies dramatically depending upon the valence state or form (organic or inorganic) of the metal. For example, Arsenic (III) and methyl mercury are more toxic than arsenic (V) and inorganic mercury, respectively. The available data on the contaminant concentrations in media do not report which species or form of contaminant was observed. Because benchmarks used for comparison represented the more toxic species/forms of the metals (particularly for arsenic and mercury), if the less toxic species/form of the metal was actually present in modeled vegetation or sediment from the Clinch River or Poplar Creek, potential toxicity at the sites may be overestimated.

# 6. CONCLUSIONS

Based upon a preliminary evaluation of the currently available data, the following conclusions may be made concerning risks to selected wide-ranging wildlife species on the ORR:

- The largest OUs on the ORR generally have the most diverse habitat and consequently can support the greatest number of potential endpoint species (Chap. 3).

- Species that can use urban habitats or have broad habitat requirements have the highest potential to experience exposure due to the large numbers of OUs that provide suitable habitat (Chapt. 3).

- Cadmium in fish presents a significant risk to mink within the Bear Creek watershed and to an estimated 17.5% of the mink population on the ORR. ORR-wide risk to mink from cadmium may be underestimated due to the lack of data from the two largest watersheds (i.e., East Fork Poplar Creek and the K-25 vicinity). Combined exposure of mink to PCBs and mercury may present a hazard to mink in East Fork Poplar Creek. Risks from contaminants in other watersheds are not significant (Chap. 4).

- Evaluation of the potential risks to a future ORR-wide population of otter indicates that cadmium in Bear Creek presents a risk to 20% of the ORR-wide population; mercury in East Fork Poplar Creek presents a risk to either 12% or 36%. Because the river otter is a state threatened species, effects to any individual is significant. Therefore the weight of evidence suggests that Cd in Bear Creek and mercury in East Fork Poplar Creek represent significant risks to establishment of a future ORR-wide river otter population (Chap. 4).

- Mercury in fish presents a significant risk to belted kingfisher within the East Fork Poplar Creek watershed and consequently to an estimated 37% of the kingfisher population on the ORR (Chap. 4).

- While mercury in fish is estimated to represent a significant risk to great blue heron within the East Fork Poplar Creek watershed and consequently to an estimated 37% of the heron population on the ORR, studies on two of five colonies adjacent to the ORR indicate that reproduction at these locations is not impaired. Contaminant bioaccumulation and reproductive success are unknown at the three additional colonies adjacent to the ORR. Additionally, the primary foraging locations for herons at the two studied colonies is unknown. Because herons can travel long distances in search of food (>15 km), they are likely to forage at offsite as well as on-site locations, reducing both the exposure they receive and the risk they experience. If birds from the unstudied colonies forage more extensively on the ORR, they may experience greater risk. Due to the high risk estimated for mercury exposure on the ORR, the lack of data for three of five heron colonies adjacent to the ORR, and uncertainty as to where birds from the five ORR colonies forage, a conclusion concerning whether or not great blue heron on the ORR are at risk cannot be made (Chap. 4).

- Based upon a habitat-based evaluation of risk, while there are significant risks to individuals of selected herbivore and vermivore endpoint species resident on OUs, the reservation-wide populations of these endpoints are unlikely to be significantly affected (<20% of the ORR population is affected). This conclusion must be viewed with caution, however because data were evaluated for only 12 of 37 OUs. Inclusion of additional OUs is likely to increase the proportion of the ORR populations exposed and at risk. (Chap. 5).

# 7. RECOMMENDED REVISION SCHEDULE

This assessment is based on only a small portion of the data available on the ORR. To accurately evaluate the nature and magnitude of risks on the ORR, all available data should be incorporated and considered. It is recommended that this report be revised and updated annually until all existing data have been incorporated. Following this, revisions should be produced on a 5-year schedule to incorporate new data that become available.

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## Appendix A

# DATA SURVEY FOR THE OAK RIDGE RESERVATION
## ECOLOGICAL MONITORING AND ASSESSMENT PROGRAM
## TERRESTRIAL WILDLIFE RISK ASSESSMENT

# DATA SURVEY FOR THE OAK RIDGE RESERVATION ECOLOGICAL MONITORING AND ASSESSMENT PROGRAM TERRESTRIAL WILDLIFE RISK ASSESSMENT

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**Oak Ridge National Laboratory**

## INTRODUCTION

Staff of the Environmental Assessment and Compliance Group were asked to perform a data information survey for the Oak Ridge Reservation Ecological Monitoring and Assessment Program (ORR-EMAP). The survey's purpose was to identify datasets potentially relevant to an upcoming terrestrial wildlife ecological risk assessment.

## SURVEY APPROACH

Primary datasets of interest were soil, sediment, biota, and surface water contaminant concentrations. Radiological studies and air sampling were not of interest to this project. The following Operable Units (OUs) were given priority based on their total non-urban or barren area:

| | |
|---|---|
| K-25: | K-901 (Area 10), K-770, K-33, K-1007 |
| ORNL: | WAG 2, WAG 3, WAG 4, WAG 5, WAG 6, WAG 7, WAG 8, WAG 11 |
| Y-12: | Bear Creek, LEFPC, Bear Creek OU1, Chestnut Ridge OU2 |
| Other OUs: | Freels Bend, South Campus |

The survey took a "top-down" approach, starting with ER Program Managers and OU Facility and Project Managers. Most of these people referred to other individuals and programs they thought might have relevant information. (See Fig. 1: Referrals.) It was hoped that this strategy would provide good general coverage of available datasets and allow those with access to datasets the opportunity to contribute.

The survey was conducted by telephone and electronic mail from March 22 through April 6, 1995. After a brief introduction of the survey's purpose, respondents were asked if they were aware of any potentially relevant studies, reports, or research. General information requested from survey participants included the following:

- What OUs are you affiliated with?
- Are you aware of any potentially relevant studies, reports, or research?
- Do you know of any individuals or programs that may have information of interest?

For each person contacted, a survey form was filled out to the extent information was known. (See Fig. A.2: Survey Participant Form.)

If potentially relevant datasets were identified, further questions were asked regarding the nature of the data including the following:

- Have these datasets been entered into a data management system such as the Oak Ridge Environmental Information System (OREIS) or the Bechtel Environmental Information Data Management System (BEIDMS)?
- What types of samples were taken?
- Who has the data in electronic form?

If most of a dataset was thought to be in a data management system such as OREIS, no further questions regarding that dataset were asked since the findings could be obtained from the system. If a dataset was not thought to be in a data management system, a blank data survey form was faxed to those who might have relevant information. (See Fig. A.3: Dataset Information Form.) Unfortunately, many of these forms were not returned.

## PERSONS CONTACTED

Persons contacted are listed in Table A.1. All are Lockheed Martin Energy Systems, Inc., employees or on-site subcontractors except where indicated.

## SURVEY FINDINGS

Interviews and returned survey forms uncovered the following information regarding OUs of interest.

<u>K-25</u>
OREIS holds surface water, sediment, toxicity, and biota data for the K-901A holding pond. The K-25 Site Environmental Monitoring program takes monthly surface water and sediment samples from the K-901A pond. SAIC is currently collecting data for K-901. The ORNL Environmental Sciences Division (ESD) sampled Canadian geese near the K-1007 pond for PCBs. SAIC holds surface water, soil, and possibly sediment data for K-770. Additional soil and sediment data for K-25 can be found in OREIS.

<u>ORNL</u>
Surface water data from seeps, springs, and tributaries, and sediment and soil data including soil characterizations and core samples have been collected for WAG 2. Results from these studies are intended for inclusion in OREIS. Some Ni sampling has been conducted for WAG 4. Water and soil from Pit 1 of WAG 7 have been sampled. Bechtel holds data regarding WAG 5.

<u>Y-12</u>
Surface water, soil, sediment, and biological information for LEFPC are in OREIS. This data includes summaries of Hg distribution and results of tests for organics. A surface water compliance testing point is located at EFPC. OREIS holds data collected in 1992 and 1993 for the EFPC Remedial Investigation (RI). EFPC data not in OREIS includes pollutant data; old surface water data; and PCB, Hg, and pesticide data for fish and algae. SAIC is currently

conducting EFPC studies. CDM obtained Chestnut Ridge soil, sediment, and surface water data. Small mammal and vegetation bioaccumulation studies have been conducted for Chestnut Ridge OU2. Two surface water sampling points for Y-12 surface water compliance are located at Bear Creek. The Bechtel Environmental Information Data Management System (BEIDMS) contains 1994 and 1995 Bear Creek Valley surface water data. A Bear Creek OU1 soils data project being conducted by SAIC is almost complete. Future studies for Y-12 include soil and sediment sampling near Bear Creek Road.

A historical data capture being conducted by SAIC has found the following surface water datasets for Bear Creek Valley:

- USGS water quality (inorganics, nitrate), 1984;
- NPDES data (inorganics and organic), 1990-94;
- organics, inorganics, and PCBs, 1990;
- organics, PCBs, inorganics, pesticides, 1993;
- inorganics, organic, 1987; and
- GWQAR data, organics, inorganics. 1986-1994 (in BEIDMS).

The Bear Creek Valley historical data capture contains the following soil and sediment information:

- organics, inorganics, PCBs, 1990 ;
- Upper Bear Creek Valley, inorganics, organics, pesticides, PCBs, 1983-84; and
- well borings, organics, inorganics, pesticides, PCBs, 1983-(unknown).

Other OUs

Jacobs Engineering holds Freels Bend data for soil, water, organics, inorganics, pesticides, PCBs, semi-volatiles, volatiles, and metals. This information is intended for inclusion in OREIS. Vegetation, soil, sediment, volatiles, and surface water data for South Campus are in OREIS.

**Table A.1. Contacts for data survey for ORR-EMAP terrestrial wildlife risk assessment**

| Name | Employer[1] | Phone | UserID[2] | Notes/project affiliation |
|---|---|---|---|---|
| Jane Aiken | | 241-3439 | XQ9 | In charge of K-901 |
| Terri Ball | | | TLS | WAG 6 |
| Lisa Baron | | 574-7393 | ISA | |
| Clay Bednarz | | 241-3926 | NRZ | WAG 4 & 11 Project Manager |
| Donna Bennett | | 574-5839 | DFH | UEFPC |
| Bud Brickeen | | 576-1579 | WBR | WAG 3 & 8 Project Manager |
| Jeff Cange | Bechtel | 220-2255 | | WAG 5 Task Manager |
| Jane Carr | | 241-3542 | J5C | ORNL Document Management Center |
| Jennifer Chason | SAIC | 481-8796 | | EFPC, Bear Creek |
| Roger Clapp | | 576-6619 | UVA | WAG 2 Technical Lead |
| Mike Coffey | | 576-5477 | C3Y | K-1007, K-901 |
| Dennis Cope | | 241-3841 | DGX | Y-12 |
| Barnaby Cornaby | SAIC | 481-8721 | | LEFPC |
| Chris Dearstone | | 576-5946, 574-7449 | KTV | Y-12 Database Administrator |
| John Forstrom | | 576-5640 | KAF | K-25 |
| Don Garrett | | 241-3501 | GA4 | WAG 6, WAG 11 |
| Patty Goddard | | 576-3692 | PG2 | K-25 ER Technical Coordinator |
| Steven Haase | | 241-5258 | 6SH | Y-12 Technical Support |
| Chuck Hadden | SAIC | 481-8733 | | Bear Creek, LEFPC |
| Kim Hanzelka | | 574-4599 | UKH | Y-12 surface water compliance |
| Al Hardesty | | 576-0311 | AFQ | WAG 5 |
| Larry Hawk | | 241-4874 | HKV | Facility Manager (WAG 2, 3, 8, . . .) |
| Kelly Henry | Jacobs | 482-5045 | | Freels Bend, South Campus |
| Steve Herbes | | 574-7336 | SEH | WAG 2 Project Manager |
| Walter Hill | | 574-2828 | | LEFPC |

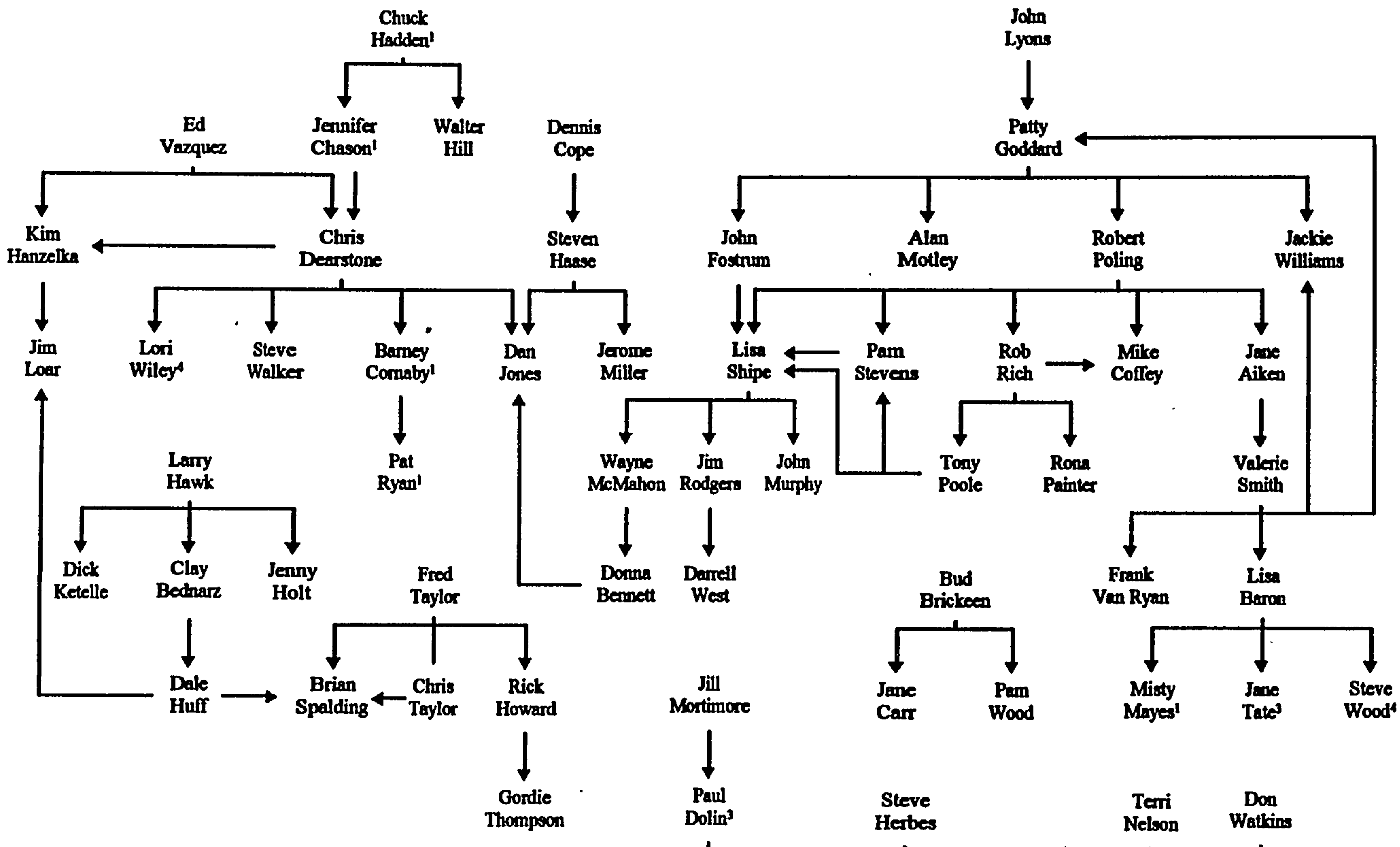
**Table A.1 (continued)**

| Name | Employer[1] | Phone | UserID[2] | Notes/project affiliation |
|---|---|---|---|---|
| Judy Hodgins | | 576-2368 | H9S | Project Manager for soil sampling at Bear Creek Road |
| Jenny Holt | | 574-7336, 873-4821 (beeper) | VH2 | |
| Rick Howard | | 241-2812 | HR5 | Facility Manager (WAG 4, 7, 11) |
| Dale Huff | | 574-7859 | DDH | WAG 4 |
| Dan Jones | | 241-5247 | | Y-12 Risk Assessment Group |
| Dick Ketelle | | 574-5762 | KET | X-10 |
| Jim Loar | | 574-7323 | LOA | |
| John Lyons | | 574-3166 | L9Y | K-25 ER Program Manager |
| Misty Mayes | SAIC | 481-4617 | | K-901 pond |
| Wayne McMahon | | 574-7525 | EIH | Y-12 EM Manager |
| Jerome Miller | | | | LEFPC |
| Jill Mortimore | | 574-1462 | JAO | Freels Bend, South Campus |
| Allen Motley | | 576-5782 | A4Z | K-25 |
| John Murphy | | 576-7929 | JMU | X-10 EM Manager |
| Terri Nelson | | 574-7033 | TRX | WAG 7 Facility and Project Manager, WAG 5 Facility Manager |
| Rona Painter | | 576-5477 | RR9 | K-25 Groundwater Program |
| Robert Poling | | 576-5493 | P8O | K-25 Groundwater Program |
| Tony Poole | | 241-3591 | D6P | K-25 ambient monitoring |
| Rob Rich | | 574-0678 | RA3 | ambient monitoring of K-901A and K-1007A ponds; stormwater sampling for Mitchell, Poplar, Clinch |
| Jim Rodgers | | 574-8982 | JGR | Environmental Compliance for all sites |
| Jean Shaakir-Ali | | 574-5359 | IJL | WAG 2 |
| Lisa Shipe | | 241-2590 | OLG | K-25 Monitoring Group |
| Valerie Smith | | 241-3518 | VD5 | K-901 and other K-25 OUs |

**Table A.1 (continued)**

| Name | Employer[1] | Phone | UserID[2] | Notes/project affiliation |
|---|---|---|---|---|
| Brian Spalding | | 574-7265 | BPS | Pit 1 of WAG 7 |
| Pam Stevens | | 576-5488 | NPT | K-25 outfalls |
| Jane Tate | Jacobs | 220-4872 | | South Campus |
| Chris Taylor | | 576-6813 | YLO | WAG 1, WAG 7 |
| Fred Taylor | | 435-3418 | FGT | Former WAG 7 Project Manager |
| Ralph Turner | | 574-7856 | RRT | Bear Creek |
| Frank Van Ryn | | 574-1907 | XS2 | K-770 |
| Ed Vazquez | | 576-1930 | EAV | Y-12 Data Management Program |
| Steve Walker | | | | Technical Lead for future soil sampling at Bear Creek Road |
| Ben Watts | | 576-4710 | BW3 | K-25 Data Management Program |
| Don Watkins | | 576-9931 | W5T | WAG 2 |
| Darrell West | | 574-7367 | DAR | |
| Lori Wiley | CDM | | | UEFPC soil sampling |
| Jackie Williams | | 241-5119 | XLW | K-25 Data Management Program |
| Kirk Wilson | | 576-5290 | QRG | WAG 6 Facility Manager |
| Pam Wood | | 576-9925 | PW7 | ORNL editor, Document control |
| Steve Wood | CDM | 482-1065 | | Chestnut Ridge OU2: soil, sediment, and surface water |

FIG. A.1. REFERRALS




1 SAIC
2 Bechtel
3 Jacobs Engineering
4 CDM

**FIG. A.2. SURVEY PARTICIPANT FORM**

PROJECT TO LOCATE DATA FOR THE OAK RIDGE RESERVATION
WHICH COULD SUPPORT ECOLOGICAL RISK ASSESSMENTS

INFORMATION ABOUT PERSONS CONTACTED **(DRAFT)**
(Complete information is requested only for authorities and custodians of surface water or soil data)

**Name of person contacted**
(last, first, middle initial)

Job title

**Three-character User ID** (or E-mail name if person has no User ID)

Phone number

Fax number

How was this person identified to be contacted? (e.g., referred to by program manager; name selected from organizational chart...)

Location

Employer (MMES, SAIC, Bechtel, ...)

Programmatic affiliation (ER, Compliance, BMAP, general research, ...)

Job responsibilities (Free form and flexible)

Operable Unit affiliations (which OU's does this person work with?)

Main role in identifying or providing data (check all that apply):

1. ____ Broad knowledge about multiple data sets
2. ____ Broad knowledge about a major program
3. ____ Detailed knowledge about one or more subprograms or tasks
4. ____ Data system expert
5. ____ Data custodian (of what data?) ______________________________
   (Add names of the data authorities)
6. ____ Data authority (of what data?) ______________________________
   (Add the name of the person who collected the data for which this person is an authority, or who was in charge of the field teams)

**FIG. A.2. SURVEY PARTICIPANT FORM (CONTINUED)**

What programs, subprograms, or data systems is this person knowledgeable about?

What subject areas (and, if relevant, specialties) (e.g., chemistry-mercury, biology-benthic macroinvertebrates, radionuclide concentrations, data management, project management...) is this person knowledgeable about?

Expected usefulness of this contact in similar future data searches

High Intermediate Low

Comments on expected usefulness:

Other comments

Contact made by:

Date(s):

Method (e.g., in person, by phone, E-mail, correspondence):

FIG. A.3. DATASET INFORMATION FORM

# DRAFT ORR-EMAP-ORNL Environmental Restoration Data Inventory

**Interview Form for Relevant Data in the 3/95 search for data to support the ORR-EMAP (Terrestrial) Ecological Risk Assessment for the Reservation (As determined by Media/Sample Matrix meeting the filter specifications)**

1. Organization (Program/Project/Division):____________________
2. SubProgram or Task:____________________
3. Data File or Model Name:____________________
4. Data Path or Location:____________________
5. Data Purpose:____________________
6. Site Area Description:____________________
7. Location Description:____________________
8. Approximate Date Range: [__/__/__ - __/__/__]
9. Media/Sample Matrix:____________________
10. Primary Custodian of Dataset:____________________
11. Phone Numbers:____________________ User ID:__________
12. Secondary Custodian of Dataset:____________________
13. Phone Numbers:____________________ User ID:__________
14. Primary Data Authority: ____________________
15. Phone Numbers:____________________ User ID:__________
16. Secondary Data Authority:____________________
17. Phone Numbers:____________________ User ID:__________
18. Data Generator:____________________
    (Subcontractor, if applicable)
19. Phone Numbers:____________________ User ID:__________
20. Approximate Time of Last Data Base Update: [__/__/__]
21. Intended Frequency of Data Base Update:____________________
    (Monthly, Quarterly, Annually, etc.)

**FIG. A.3. DATASET INFORMATION FORM (CONTINUED)**

22. Abstract:________________________________________

23. Archive Software: ____________________
(Current Database)

24. Hardware Used:________
(Original Platform)

25. Presentation Format:____________________
Tabular (Spreadsheet)
Textual (Word Processing)
Graphical (non-spatial raster image)
Spatial (True Earth GIS file)

26. Grid System:________
(X-10, Admin, TN SP, Lat/Long)

27. Distribution Point:______________________________
(ORNL Domain Name, IP Address)

28. Comments/Other Information:__________________________

29. Keywords:________________________________________

30. Identifiers:______________________________________

31. Estimated Size:___________________________________

32. Validation/Evaluation (Yes/No):________________ 33. If "Yes," Describe Type:

34. Data Dictionary (Yes/No):_____________________________

35. Reports: (attach additional page, if needed)

1) DMC Number:__________________________ Date Published:______
Title:____________________________________________

2) DMC Number:__________________________ Date Published:______
Title:____________________________________________

3) DMC Number:__________________________ Date Published:______
Title:____________________________________________

**FIG. A.3. DATASET INFORMATION FORM (CONTINUED)**

This information SUPPLEMENTS that obtained for the Draft ORR-EMAP-ORNL Environmental Restoration Data Inventory Interview Form (from Gordie Thompson) as supported by its "Classification Scheme"

Number (hand-assigned) of the Interview Form which this sheet supplements________________

Name by which data are known, or a descriptive name for the data. (Example: "BMAP Fish Community sampling data")

Types of samples

Contaminant levels Toxicity General water quality Biota status

Other________________________________________________________

Types of contaminants, biota, or other measurements represented by the data (e.g., toxicity of noncharacterized water to Ceriodaphnia dubia; levels of n congeners of PCB's; metals; bioaccumulation study of x in blue herons; ...) (also attach a list of variables or a summary of data if available)

How many stations or locations were sampled? (approximate is OK)?

If soil samples are included, were these ____Surface? ____Shallow (<12")? ____Deep (>12")?

What is/was the frequency of sampling?

Is sampling ongoing?

If ongoing, provide the scheduled end date if there is one

Sampling method(s)

**FIG. A.3. DATASET INFORMATION FORM (CONTINUED)**

Analysis method(s)

Are qualifiers included in the data set (Y/N)? ____ If yes, indicate type(s) included

_____ Lab?
_____ Validation?
_____ Other? ____________________________________________

Are nondetects included in the data set? _____

Please characterize the level of data assessment (QA/QC):

_____ Validation/evaluation performed?
(If yes, what type of validation/evaluation was performed?)

_____ Are validation/Evaluation results included in the electronic data?

_____ Collected under ER standards prevailing at the time of collection?

What approximate percentage of relevant data are in the Oak Ridge Environmental Information System (OREIS)?

Recommended media for transfer (obtain from OREIS; electronically via ftp; diskette(s),...)

Cutoff date for fully validated data

Cutoff date for unvalidated but available data

Any special considerations relating to use of the data?

**FIG. A.3. DATASET INFORMATION FORM (CONTINUED)**

Person who compiled this information

Date information was compiled

1. All persons are thought to be employees of Lockheed Martin Energy Systems, Inc. (LMES) except where indicated.

2. E-mail address is UserID@ORNL.GOV

# Appendix B

# TABLES FOR CHAPTER 3: EVALUATION OF THE POTENTIAL USE OF OPERABLE UNITS ON THE OAK RIDGE RESERVATION BY WILDLIFE

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Mallard duck | Ponds, lakes, slow-moving streams or rivers. shallow water (<41 cm) for feeding | DeGraaf and Rudis 1986 |
| Cumberland slider | Found in shallow freshwaters with lots of aquatic vegetation. They will inhabit mainly larger bodies of water with deep water avilable (3 feet or more). | Meyers-Schone and Walton 1994 |
| Mink | Streambanks, lakeshores, and marshes. Favors forested wetlands with abundant cover such as thickets, rocks, or windfalls. | DeGraaf and Rudis 1986 |
| River otter | Borders of streams, lakes or other wetlands in forested areas. | DeGraaf and Rudis 1986 |
| Great blue heron | All sizes and types of bodies of water that contain fish | DeGraaf and Rudis 1986 |
| Belted kingfisher | Earthen bank for nesting; pond, lake, stream, or river for feeding. | DeGraaf and Rudis 1986 |
| Bald eagle | Large bodies of water that contain fish, large living trees for nesting. Low human disturbance. | DeGraaf and Rudis 1986 |
| Osprey | Near large bodies of water that support abundant fish. Along rivers and lakes | DeGraaf and Rudis 1986 |
| Double-crested cormorant | Found on rocky coasts, beaches, inland lakes and rivers. | National Geographic Society 1987 |
| Black-crowned night heron | Ponds, lakes, marshes, slow streams with pools, or rivers | DeGraaf and Rudis 1986 |
| Northern water snake | Aquatic and semi aquatic habitats | DeGraaf and Rudis 1986 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Pied-billed grebe | Lakes, rivers, or ponds with emergent vegetation and open water | DeGraaf and Rudis 1986 |
| Leopard frog | all types of shallow freshwater habitats; includes streams, rivers, ponds, or lakes | Conant 1986 |
| Hellbender | Almost always found in rivers and larger streams where water is running and ample shelter is available in the form of large rocks, snags, or debris. | Conant 1986 |
| Rough-winged swallows | Nearly any open area with adequate nest sites and a water supply (usually a stream). Often river valleys and lake shores. | DeGraaf and Rudis 1986 |
| Gray bat | Cave residents year-round, although different caves are occupied in summer and winter. Forage over lakes and rivers. | Harvey 1992 |
| Indiana bat | Favors limestone caves with pools of water. Solitary females or small maternity colonies bear young in hollow trees or under loose bark. Forages over riparian forest and associated fields | DeGraaf and Rudis 1986<br>Mumford and Whitaker 1982 |
| Eastern small footed bat | In or near woodland in caves, mine tunnels, buildings, crevices in rocks. Maternity colonies have been observed in buildings. Forages low over trees and brush | DeGraaf and Rudis 1986<br>Burt and Grossenheider 1976 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Rafinesque's big-eared bat | Hibernate in caves, mines or similar habitats. Maternity colonies are usually found in abandoned buildings. Siuspected to be a forest-inhabiting bat. | Harvey 1992<br>Mumford and Whitaker 1982 |
| American toad | Almost any habitat: gardens, woods, yards with cover, damp soil, and a food supply<br>Usually in moist upland woods | DeGraaf and Rudis 1986 |
| American woodcock | Moist woodlands in early stages of succession, swamps, stream banks, bogs, rich bottomlands, brushy edges of woods, dry open woods and fields. | DeGraaf and Rudis 1986 |
| European starling | Farm, city, orchard, gardens, parks; Prefers rural areas w/pastures or hayfields; If forests, prefers stands with low percent canopy cover. More common in vicinity of human habitations. | DeGraaf and Rudis 1986 |
| American robin | Open woods and fields. Forages primarily in lawns, gardens, grassy fields, etc. | DeGraaf and Rudis 1986 |
| Short-tailed shrew | Both timbered fairly open habitats: deciduous, mixed, and less often coniferous forests with moist loose humus; especially common along banks of streams and in meadows with tall rank grasses or sedges, brush piles, and stone walls. Avoids dry, warm sites. | DeGraaf and Rudis 1986 |
| Long-tailed shrew | found in deciduous and mixed forest. | DeGraaf and Rudis 1986 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Masked shrew | Damp deciduous and coniferous woodlands with grasses, rocks, logs, or stumps for cover; bogs and other moist areas. | DeGraaf and Rudis 1986 |
| Smokey shrew | Damp, boulder-strewn, upland woods with thick leafmold. Typically near streams with moss-covered banks. | DeGraaf and Rudis 1986 |
| Southeastern shrew | Open fields and woodlots | Burt and Grossenheider 1976 |
| Six-line racerunner | Dry regions in sparse woods with loose/sandy soil and short grasses. | Smith 1967 |
| Slender glass snake | dry grasslands or dry open woods | Conant 1986 |
| Tennessee cave salamander | caves with water (species has external gills) | Conant 1986 |
| Green salamander | humid rocky areas where rock faces remain moist and well protected from sun and direct rain. | Conant 1986 |
| Raccoon | Wooded areas interrupted by fields and water courses. Not usually found in dense forests, commonly found in wetlands near human habitation. | DeGraaf and Rudis 1986 |
| Wood duck | Shallow waters of ponds, lakes, or marshes having abundant floating and emergent vegetation. Wooded swamps or open flooded lowland forests where food is available. | DeGraaf and Rudis 1986 |
| Muskrat | Marshes, shallow portions of lakes, ponds, swamps, sluggish streams, drainage ditches. Most abundant in areas with cattails. | DeGraaf and Rudis 1986 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| White-tailed deer | Mosaic of forests and open areas | DeGraaf and Rudis 1986 |
| Wild turkey | Mast-producing woodlands. Ideal habitat is a network of open, mixed forests and fields. | DeGraaf and Rudis 1986 |
| Canada goose | marshes, shores of ponds and lakes, grassy fields or agricultural lands that provide additional grazing areas. | DeGraaf and Rudis 1986 |
| Eastern cottontail | Farmlands, pastures, fallow fields, open woodlands, thickets along fence rows and stone walls, edges of forests. swamps and marshes, suburban areas with adequate food and cover. Avoids dense woods. | DeGraaf and Rudis 1986 |
| Groundhog | Open land. Edges of woodlands (seldom in interior), open cultivated land, pastures, meadows, open brushy hillsides. | DeGraaf and Rudis 1986 |
| Grasshopper sparrow | Hayfields, weedy fallow fields, prairies. Avoids shrubby fields. Birds favor uplands with ground vegetation of various densities. | DeGraaf and Rudis 1986 |
| Henslow's sparrow | Neglected weedy fields-commonly of broomsedge-wet meadows, saltmarsh edges. Occaisionally in dry and cultivated uplands. May fovor moist lowland habitat and may use areas with widely scattered shrubs. | DeGraaf and Rudis 1986 |
| Lark sparrow | generally prefers sites with grasslands or open woodlands | National Geographc Society 1987 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Vesper sparrow | Breed in short-grass meadows, pastures, hayfields, cultivated grain fields, dry open uplands, burned and cut-over areas in forests, country roadsides. Birds favor sparsely vegetated uplands and may use areas with widely scattered shrubs. | DeGraaf and Rudis 1986Red-tailed Hawk |
| Red-tailed hawk | Deciduous and mixed woodlands interspersed with meadows, brushy pastures, open bogs, and swampy areas. Large openings for foraging. | DeGraaf and Rudis 1986 |
| Golden eagle | Elevated nest sites, especially cliffs. Broad expanses of open land for hunting. 50 to 100 square mile home range. | DeGraaf and Rudis 1986 |
| Northern harrier | Open country with herbaceous or low woody vegetation for nest concealment. | DeGraaf and Rudis 1986 |
| Cooper's hawk | Extensive deciduous or mixed woodlands that are dense or open, scattered woodlots interspersed with open fields. Occupies similar forest niche as Sharp-shinned Hawk but has broadened its habitat by moving into more open agricultural areas. Flood plain forests and wooded swamps. | DeGraaf and Rudis 1986 |
| Red-shouldered hawk | Moist hardwood or mixed woodlands, wooded swamps, bottomlands and wooded margins of marshes often close to cultivated fields. | DeGraaf and Rudis 1986 |

**Table B.1. Habitat requirements for assessment and measurement endpoints on the ORR**

| Species | General habitat requirements | Citation |
|---|---|---|
| Sharp-shinned hawk | Open mixed or coniferous woodlands, clearing, edges. Extensive open mixed woodlands that are free from human disturbance. | DeGraaf and Rudis 1986 |
| Barn owl | Almost anywhere in open country but prefers vicinity of farms and villages. Avoids woodlands and higher elevations. | DeGraaf and Rudis 1986 |
| Black vulture | Common in open country and around human settlements, avoids heavily forested areas | Ehrlich 1988 |
| Cougar | Found throughout all habitat types and successional stages. Requires isolation away from human disturbance. Home ranges may vary in size from 5 to 96 square miles. | DeGraaf and Rudis 1986 |
| Red fox | A mixture of forest and open areas is preferred. Unbroken fields and dense forests avoided. Edges used heavily. | DeGraaf and Rudis 1986 |
| Snapping turtle | Any permanent body of freshwater, large or small. | DeGraaf and Rudis 1986 |
| Black rat snake | Variety of habitats including woodlands, thickets, field edges, farmlands, rocky hillsides, river bottoms, old barns. | DeGraaf and Rudis 1986 |
| Northern pine snake | Flat, sandy pine barrens, sandhills, and dry mountain ridges, most often in or near pine woods. | Conant 1986 |

**Table B.2. Summary of landcover types identified on the ORR and expected use by assessment and measurement endpoints**

| Species | Landcover types[a] on the ORR | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Other |
| Mallard duck | | X | | | | | | | | |
| Cumberland slider | | X | | | | | | | | |
| Mink | | X | | | X | X | | | | water primary; forest secondary |
| River otter | | X | | | X | X | | | | water primary; forest secondary |
| Great blue heron | | X | | | | | | | | |
| Belted kingfisher | | X | | | | | | | | |
| Bald eagle | | X | | | | | | | | large bodies of water |
| Osprey | | X | | | | | | | | large bodies of water |
| Double-crested cormorant | | X | | | | | | | | large bodies of water |
| Black-crowned night heron | | X | | | | | | | | |
| Northern water snake | | X | | | | | | | | |
| Pied-billed grebe | | X | | | | | | | | |
| Leopard frog | | X | | | | | | | | |
| Hellbender | | X | | | | | | | | |
| Rough-winged swallows | | X | | | | | X | X | | Earthen Banks |

**Table B.2. Summary of landcover types identified on the ORR and expected use by assessment and measurement endpoints**

| | Landcover types[a] on the ORR | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Other |
| Gray bat | | X | | | | | | | | large bodies of water, caves |
| Indiana bat | | X | | | X | X | X | X | | |
| Eastern small footed bat | | | | | X | | X | X | | |
| Rafinesque's big-eared bat | X (buiildings) | | X | X | X | X | | | | Caves |
| American toad | | X | X | X | X | X | | | | forest primary; water secondary |
| American woodcock | | | | | X | X | X | X | | |
| European starling | X | | X | X | X | X | X | X | | |
| American robin | X | | X | X | X | X | X | X | | |
| Short-tailed shrew | | | X | X | X | X | | X | | |
| Long-tailed shrew | | | | | X | X | | | | |
| Masked shrew | | | | | X | X | | | | |
| Smokey shrew | | | | | X | X | | | | |
| Southeastern shrew | | | X | X | X | X | X | X | | |
| Six-line racerunner | | | X | X | X | X | X | X | | |
| Slender glass snake | | | X | X | X | X | X | X | | |
| Tennessee cave salamander | | | | | | | | | | Caves |

**Table B.2. Summary of landcover types identified on the ORR and expected use by assessment and measurement endpoints**

| Species | Landcover types[a] on the ORR | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Other |
| Green salamander | | | | | | | | | | moist, rocky sites |
| Raccoon | X | X | X | X | X | X | X | X | | |
| Wood duck | | X | | | X | X | | | | |
| Muskrat | | X | | | | | | | | |
| White-tailed deer | | | X | X | X | X | X | X | | |
| Wild turkey | | | X | X | X | X | X | X | | |
| Canada goose | X | X | | | | | X | | | |
| Eastern cottontail | X | | | | | | X | X | | |
| Groundhog | X | | | | | | X | X | | |
| Grasshopper sparrow | | | | | | | X | X | | |
| Henslow's sparrow | | | | | | | X | X | | |
| Lark sparrow | | | | | X | X | X | X | | |
| Vesper sparrow | | | | | | | X | X | | |
| Red-tailed hawk | | | X | X | X | X | X | X | | |
| Golden eagle | | | | | | | | | | use of ORR unlikely[B] |
| Northern harrier | | | | | | | X | X | | |
| Cooper's hawk | | | | | X | X | X | X | | |

**Table B.2. Summary of landcover types identified on the ORR and expected use by assessment and measurement endpoints**

| Species | Landcover types[a] on the ORR | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Other |
| Red-shouldered hawk | | | | | X | X | | | | |
| Sharp-shinned hawk | | | | | X | X | | | | |
| Barn owl | X | | | | | | X | X | | |
| Black vulture | | | | | | | X | X | | |
| Cougar | | | X | X | X | X | X | X | | use of ORR unlikely[C] |
| Red fox | | | X | X | X | X | X | X | | |
| Snapping turtle | | X | | | | | | | | |
| Black rat snake | X | | X | X | X | X | X | X | | |
| Northern pine snake | | | X | X | | X | | | | |

[a] Definitions of habitat types are presnted in Table 1. X in cell indicates use of habitat by listed endpoint species.
[B] While golden eagles may migrate through the ORR, because the ORR does not contain large expanses of open habitat, significant use of any area on the ORR is highly unlikely.
[C] Because the ORR does not contain large expanses of habitat away from human disturbance, significant use of any area on the ORR is highly unlikely.

**Table B.3. Summary of landcover types identified on OUs on the ORR**

| OU | Area (ha) by landcover type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Total |
| Area 10 (K-901) | 15.94 | 3.56 | 1.75 | 0.31 | 6.87 | 7.62 | 3.19 | 38.31 | | 77.5 |
| K-33 | 65 | 0.12 | | | 2.94 | 0.87 | 5.06 | 13.94 | 0.37 | 88.3 |
| K-1064 | 110.6 | | | | | | 0.19 | 3.56 | 0.06 | 14.87 |
| K-1410 | 3.19 | | | | | | | 0.31 | | 3.5 |
| K-29 | 25.62 | | | | | | 0.62 | 0.88 | | 27.12 |
| K-1007 | 13.75 | 7.62 | | | | | 0.19 | 0.75 | | 22.31 |
| K-1413 | 1.31 | | | | | | | | | 1.31 |
| K-1004 | 2.94 | | | | | | | | | 2.94 |
| K-1070-C/D | 6.56 | | | | 1.69 | 0.19 | 0.25 | 4.37 | | 13.06 |
| K-1401 | 8.06 | | | | | | | | | 8.06 |
| K-1420 | 2.31 | | | | | | | | | 2.31 |
| K-1407 | 12.31 | 0[a] | | | | | | 4.19 | | 16.5 |
| K-770 | 43.81 | 2 | 2.37 | 1.06 | 4.37 | 3.12 | 4.19 | 28 | 0.06 | 88.98 |
| WAG 1 | 48.18 | 0[a] | 0.81 | | 1.25 | 0.81 | 0.94 | | | 51.99 |
| WAG 2 | 13 | 9 | 1 | | 15.75 | 29 | 0.06 | 14.81 | | 82.62 |
| WAG 3 | 0.56 | | 0.19 | | 1.06 | 2.19 | 0.06 | 8.12 | | 12.18 |
| WAG 4 | 6.37 | 0[a] | | | 2.19 | 1.19 | 4.5 | 1.06 | | 15.31 |

**Table B.3. Summary of landcover types identified on OUs on the ORR**

| OU | Area (ha) by landcover type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Total |
| WAG 5 | 10.19 | 0[a] | 0.25 | | 3.56 | 6.44 | 7.69 | 9.06 | | 37.19 |
| WAG 6 | 25.5 | 0.75 | | | 5.06 | 2.06 | 0.5 | 2.94 | | 36.81 |
| WAG 7 | 5.37 | 0[a] | 1.44 | | 17.25 | 25.31 | 0.12 | 8.31 | | 57.8 |
| WAG 8 | 17.81 | | 3.44 | | 1.44 | 3.785 | | 5.12 | | 31.56 |
| WAG 9 | 1.37 | | | | 0.25 | 0.06 | | 0.31 | | 1.99 |
| WAG 10 | 0.5 | | 0.12 | | 0.06 | 0.19 | | 0.25 | | 1.12 |
| WAG 11 | 0.31 | | 4.56 | | 0.81 | 3.81 | 0.37 | 5.12 | | 14.98 |
| WAG 13 | 0.56 | | 0.12 | | 0.18 | 0.44 | 0.37 | 1.81 | | 3.48 |
| Bear Creek | 85.37 | 0[a] | 37.37 | 20.94 | 192.81 | 140.56 | 14.62 | 246.06 | 0.44 | 738.17 |
| BC OU1 | 9.5 | | | | 8.19 | 0.25 | 9.19 | 24 | 0.25 | 51.38 |
| BC OU2 | 4.12 | | | | | | | 0.62 | 0.06 | 4.8 |
| CR OU1 | 1.5 | | | | | 0.19 | 2.5 | 2.06 | | 6.25 |
| CR OU2 | 0.94 | 0.06 | | | 3.81 | 0.38 | | 2.62 | | 7.81 |
| CR OU3 | 0.31 | | | | | | 0.19 | | | 0.5 |
| CR OU4 | 1.44 | 3.94 | | | 0.06 | 0.06 | 0.19 | 0.56 | 0.31 | 6.56 |
| Lower East Fork Poplar Creek | 99.81 | 0.19 | 7.37 | 2.62 | 41.06 | 50.87 | 8.5 | 133.87 | 2 | 344.29 |
| UEFPC OU2 | 3.56 | | | | | | | | | 3.56 |

Table B.3. Summary of landcover types identified on OUs on the ORR

| OU | Area (ha) by landcover type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Water | Pine forest | Pine plant. | Decid. forest | Mixed forest | Pasture | Trans. | Barren | Total |
| UEFPC OU3 | 5.19 | | | | | | | | | 5.19 |
| Freels Bend | 0.75 | 1.12 | | 0.06 | 2.06 | 3.88 | 0.81 | 4.56 | | 13.49 |
| South Campus Facility | 9.81 | 0.44 | 0.06 | 0.06 | | | 13.25 | 4.5 | 0.44 | 28.56 |

[a] While no surface water was observed in the satellite image, surface water is known to be present at this site.

Table B.4. Summary of habitat availability for assessment and measurment endpoints at K-25 OUs [a]

| | K-901 | K-33 | K-1064 | K-1410 | K-29 | K-1007 | K-1413 | K-1004 | K-1070-C/D | K-1401 | K-1420 | K-1407 | K-770 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mallard duck | x | x | | | | x | | | | | | x | x |
| Cumberland slider | x | x | | | | x | | | | | | x | x |
| Mink | x | x | | | | x | | | | | | x | x |
| River otter | x | x | | | | x | | | | | | x | x |
| Great blue heron | x | x | | | | x | | | | | | x | x |
| Belted kingfisher | x | x | | | | x | | | | | | x | x |
| Bald eagle | x | | | | | x | | | | | | | |
| Osprey | x | | | | | x | | | | | | | |
| Double-crested cormorant | x | | | | | x | | | | | | | |
| Black-crowned night heron | x | x | | | | x | | | | | | x | x |
| Northern Water snake | x | x | | | | x | | | | | | x | x |
| Pied-billed grebe | x | x | | | | x | | | | | | x | x |
| Leopard frog | x | x | | | | x | | | | | | x | x |
| Hellbender | | | | | | | | | | | | | |
| Rough-winged swallows | x | x | | | | x | | | x | | | x | x |
| Gray bat | x | | | | | x | | | | | | | |
| Indiana bat | x | x | x | x | x | x | | | x | | | x | x |
| Eastern small footed bat | x | x | x | x | x | x | | | x | | | x | x |

Table B.4. Summary of habitat availability for assessment and measurment endpoints at K-25 OUs [a]

| | K-901 | K-33 | K-1064 | K-1410 | K-29 | K-1007 | K-1413 | K-1004 | K-1070-C/D | K-1401 | K-1420 | K-1407 | K-770 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rafinesque's big-eared bat | x | x | x | x | x | x | x | x | x | x | x | x | x |
| American toad | x | x | | | | | | | x | | | | x |
| American woodcock | x | x | x | x | x | x | | | x | | | x | x |
| European starling | x | x | x | x | x | x | x | x | x | x | x | x | x |
| American robin | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Short-tailed shrew | x | x | | | | | | | x | | | | x |
| Long-tailed shrew | x | x | | | | | | | x | | | | x |
| Masked shrew | x | x | | | | | | | x | | | | x |
| Smokey shrew | x | x | | | | | | | x | | | | x |
| Southeastern shrew | x | x | x | x | x | x | | | x | | | x | x |
| Six-line racerunner | x | x | x | x | x | x | | | x | | | x | x |
| Slender glass snake | x | x | x | x | x | x | | | x | | | x | x |
| Tennessee cave salamander | | | | | | | | | | | | | |
| Green salamander | | | | | | | | | | | | | |
| Raccoon | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Wood duck | x | x | | | | x | | | | | | x | x |
| Muskrat | x | x | | | | x | | | | | | x | x |
| White-tailed deer | x | x | x | x | x | x | | | x | | | x | x |
| Wild turkey | x | x | x | x | x | x | | | x | | | x | x |

**Table B.4. Summary of habitat availability for assessment and measurment endpoints at K-25 OUs [a]**

| | K-901 | K-33 | K-1064 | K-1410 | K-29 | K-1007 | K-1413 | K-1004 | K-1070-C/D | K-1401 | K-1420 | K-1407 | K-770 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada goose | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Eastern cottontail | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Groundhog | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Grasshopper sparrow | x | x | x | x | x | x | | | x | | | x | x |
| Henslow's sparrow | x | x | x | x | x | x | | | x | | | x | x |
| Lark sparrow | x | x | x | x | x | x | | | x | | | x | x |
| Vesper sparrow | x | x | x | x | x | x | | | x | | | x | x |
| Red-tailed hawk | x | x | x | x | x | x | | | x | | | x | x |
| Golden eagle | | | | | | | | | | | | | |
| Northern harrier | x | x | x | x | x | x | | | x | | | x | x |
| Cooper's hawk | x | x | x | x | x | x | | | x | | | x | x |
| Red-shouldered hawk | x | x | | | | | | | x | | | | x |
| Sharp-shinned hawk | x | x | | | | | | | x | | | | x |
| Barn owl | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Black vulture | x | x | x | x | x | x | | | x | | | x | x |
| Cougar | | | | | | | | | | | | | |
| Red fox | x | x | x | x | x | x | | | x | | | x | x |
| Snapping turtle | x | x | | | | x | | | | | | x | x |
| Black rat snake | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Northern pine snake | x | x | | | | | | | x | | | | x |

Table B.4. Summary of habitat availability for assessment and measurment endpoints at K-25 OUs [a]

| | K-901 | K-33 | K-1064 | K-1410 | K-29 | K-1007 | K-1413 | K-1004 | K-1070-C/D | K-1401 | K-1420 | K-1407 | K-770 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total number of endpoints/OU | 52 | 48 | 26 | 26 | 26 | 44 | 9 | 9 | 35 | 9 | 9 | 40 | 48 |

[a] X=presence of at least one habitat category prefered by the endpoint. Amount of suitable habitat not considered; only presence/absence of habitat.

Table B.5. Summary of habitat availability for assessment and measurment endpoints at X-10 OUs[a]

| | WAG 1 | WAG 2 | WAG 3 | WAG 4 | WAG 5 | WAG 6 | WAG 7 | WAG 8 | WAG 9 | WAG 10 | WAG 11 | WAG 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mallard duck | x | x | | x | x | x | x | | | | | |
| Cumberland slider | x | x | | x | x | x | x | | | | | |
| Mink | x | x | | x | x | x | x | | | | | |
| River otter | | x | | x | x | x | x | | | | | |
| Great blue heron | x | x | | x | x | x | x | | | | | |
| Belted kingfisher | x | x | | x | x | x | x | | | | | |
| Bald eagle | | x (WOL)[b] | | | | | | | | | | |
| Osprey | | x (WOL)[b] | | | | | | | | | | |
| Double-crested cormorant | | x (WOL)[b] | | | | | | | | | | |
| Black-crowned night heron | x | x | | x | x | x | x | | | | | |
| Northern water snake | x | x | | x | x | x | x | | | | | |
| Pied-billed grebe | x | x | | x | x | x | x | | | | | |
| Leopard frog | x | x | | x | x | x | x | | | | | |
| Hellbender | | x | | x | x | x | x | | | | | |
| Rough-winged swallows | x | x | x | x | x | x | x | x | x | x | x | x |
| Gray bat | | x (WOL)[b] | | | | | | | | | | |
| Indiana bat | x | x | x | x | x | x | x | x | x | x | x | x |
| Eastern small footed bat | x | x | x | x | x | x | x | x | x | x | x | x |

Table B.5. Summary of habitat availability for assessment and measurment endpoints at X-10 OUs[a]

| | WAG 1 | WAG 2 | WAG 3 | WAG 4 | WAG 5 | WAG 6 | WAG 7 | WAG 8 | WAG 9 | WAG 10 | WAG 11 | WAG 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rafinesque's big-eared bat | x | x | x | x | x | x | x | x | x | x | x | x |
| American toad | x | x | x | x | x | x | x | x | x | x | x | x |
| American woodcock | x | x | x | x | x | x | x | x | x | x | x | x |
| European starling | x | x | x | x | x | x | x | x | x | x | x | x |
| American robin | x | x | x | x | x | x | x | x | x | x | x | x |
| Short-tailed shrew | x | x | x | x | x | x | x | x | x | x | x | x |
| Long-tailed shrew | x | x | x | x | x | x | x | x | x | x | x | x |
| Masked shrew | x | x | x | x | x | x | x | x | x | x | x | x |
| Smokey shrew | x | x | x | x | x | x | x | x | x | x | x | x |
| Southeastern shrew | x | x | x | x | x | x | x | x | x | x | x | x |
| Six-line racerunner | x | x | x | x | x | x | x | x | x | x | x | x |
| Slender glass snake | x | x | x | x | x | x | x | x | x | x | x | x |
| Tennessee cave salamander | | | | | | | | | | | | |
| Green salamander | | | | | | | | | | | | |
| Raccoon | x | x | x | x | x | x | x | x | x | x | x | x |
| Wood duck | x | x | | x | x | x | x | | | | | |
| Muskrat | x | x | | x | x | x | x | | | | | |
| White-tailed deer | x | x | x | x | x | x | x | x | x | x | x | x |
| Wild turkey | x | x | x | x | x | x | x | x | x | x | x | x |
| Canada goose | x | x | x | x | x | x | x | x | x | x | x | x |

Table B.5. Summary of habitat availability for assessment and measurment endpoints at X-10 OUs[a]

| | WAG 1 | WAG 2 | WAG 3 | WAG 4 | WAG 5 | WAG 6 | WAG 7 | WAG 8 | WAG 9 | WAG 10 | WAG 11 | WAG 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eastern cottontail | x | x | x | x | x | x | x | x | x | x | x | x |
| Groundhog | x | x | x | x | x | x | x | x | x | x | x | x |
| Grasshopper sparrow | x | x | x | x | x | x | x | x | x | x | x | x |
| Henslow's sparrow | x | x | x | x | x | x | x | x | x | x | x | x |
| Lark sparrow | x | x | x | x | x | x | x | x | x | x | x | x |
| Vesper sparrow | x | x | x | x | x | x | x | x | x | x | x | x |
| Red-tailed hawk | x | x | x | x | x | x | x | x | x | x | x | x |
| Golden eagle | | | | | | | | | | | | |
| Northern harrier | x | x | x | x | x | x | x | x | x | x | x | x |
| Cooper's hawk | x | x | x | x | x | x | x | x | x | x | x | x |
| Red-shouldered hawk | x | x | x | x | x | x | x | x | x | x | x | x |
| Sharp-shinned hawk | x | x | x | x | x | x | x | x | x | x | x | x |
| Barn owl | x | x | x | x | x | x | x | x | x | x | x | x |
| Black vulture | x | x | x | x | x | x | x | x | x | x | x | x |
| Cougar | | | | | | | | | | | | |
| Red fox | x | x | x | x | x | x | x | x | x | x | x | x |
| Snapping turtle | x | x | | x | x | x | x | | | | | |
| Black rat snake | x | x | x | x | x | x | x | x | x | x | x | x |
| Northern pine snake | x | x | x | x | x | x | x | x | x | x | x | x |

**Table B.5. Summary of habitat availability for assessment and measurment endpoints at X-10 OUs[a]**

| | WAG 1 | WAG 2 | WAG 3 | WAG 4 | WAG 5 | WAG 6 | WAG 7 | WAG 8 | WAG 9 | WAG 10 | WAG 11 | WAG 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total number of endpoints/OU | 47 | 53 | 35 | 49 | 49 | 49 | 49 | 35 | 35 | 35 | 35 | 35 |

[a] X=presence of at least one habitat category prefered by the endpoint. Amount of suitable habitat not considered; only presence/absence of habitat.
[b] WOL = suitable habitat only at White Oak Lake.

Table B.6. Summary of habitat availability for assessment and measurment endpoints at Y-12 OUs, Freel's Bend, and the South Campus Facility[a]

| | Bear Creek | BC OU1 | BC OU2 | CR OU1 | CR OU2 | CR OU3 | CR OU4 | LEFPC | UEFPC OU2 | UEFPC OU3 | Freels Bend | SCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mallard duck | x | | | | | | x | x | | | x | x |
| Cumberland slider | x | | | | | | x | x | | | x | x |
| Mink | x | | | | | | x | x | | | x | x |
| River otter | x | | | | | | x | x | | | x | x |
| Great blue heron | x | | | | | | x | x | | | x | x |
| Belted kingfisher | x | | | | | | x | x | | | x | x |
| Bald eagle | | | | | | | | | | | | |
| Osprey | | | | | | | | | | | | |
| Double-crested cormorant | | | | | | | | | | | | |
| Black-crowned night heron | x | | | | | | x | x | | | x | x |
| Northern water snake | x | | | | | | x | x | | | x | x |
| Pied-billed grebe | x | | | | | | x | x | | | x | x |
| Leopard frog | x | | | | | | x | x | | | x | x |
| Hellbender | x | | | | | | | x | | | | |
| Rough-winged swallows | x | x | x | x | x | | x | x | | | x | x |
| Gray bat | | | | | | | | | | | | |
| Indiana bat | x | x | x | x | x | x | x | x | | | x | x |
| Eastern small footed bat | x | x | x | x | x | x | x | x | | | x | x |

Table B.6. Summary of habitat availability for assessment and measurment endpoints at Y-12 OUs, Freel's Bend, and the South Campus Facility[a]

| | Bear Creek | BC OU1 | BC OU2 | CR OU1 | CR OU2 | CR OU3 | CR OU4 | LEFPC | UEFPC OU2 | UEFPC OU3 | Freels Bend | SCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rafinesque's big-eared bat | x | x | x | x | x | x | x | x | x | x | x | x |
| American toad | x | x | | x | x | | x | x | | | x | x |
| American woodcock | x | x | x | x | x | x | x | x | | | x | x |
| European starling | x | x | x | x | x | x | x | x | x | x | x | x |
| American robin | x | x | x | x | x | x | x | x | x | x | x | x |
| Short-tailed shrew | x | x | | x | x | | x | x | | | x | x |
| Long-tailed shrew | x | x | | x | x | | x | x | | | x | |
| Masked shrew | x | x | | x | x | | x | x | | | x | |
| Smokey shrew | x | x | | x | x | | x | x | | | x | |
| Southeastern shrew | x | x | x | x | x | x | x | x | | | x | x |
| Six-line racerunner | x | x | x | x | x | x | x | x | | | x | x |
| Slender glass snake | x | x | x | x | x | x | x | x | | | x | x |
| Tennessee cave salamander | | | | | | | | | | | | |
| Green salamander | | | | | | | | | | | | |
| Raccoon | x | x | x | x | x | x | x | x | x | x | x | x |
| Wood duck | x | | | | | | x | x | | | x | x |
| Muskrat | x | | | | | | x | x | | | x | x |
| White-tailed deer | x | x | x | x | x | x | x | x | | | x | x |

Table B.6. Summary of habitat availability for assessment and measurment endpoints at Y-12 OUs, Freel's Bend, and the South Campus Facility[a]

| | Bear Creek | BC OU1 | BC OU2 | CR OU1 | CR OU2 | CR OU3 | CR OU4 | LEFPC | UEFPC OU2 | UEFPC OU3 | Freels Bend | SCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild turkey | x | x | x | x | x | x | x | x | | | x | x |
| Canada goose | x | x | x | x | x | x | x | x | x | x | x | x |
| Eastern cottontail | x | x | x | x | x | x | x | x | x | x | x | x |
| Groundhog | x | x | x | x | x | x | x | x | x | x | x | x |
| Grasshopper sparrow | x | x | x | x | x | x | x | x | | | x | x |
| Henslow's sparrow | x | x | x | x | x | x | x | x | | | x | x |
| Lark sparrow | x | x | x | x | x | x | x | x | | | x | x |
| Vesper sparrow | x | x | x | x | x | x | x | x | | | x | x |
| Red-tailed hawk | x | x | x | x | x | x | x | x | | | x | x |
| Golden eagle | | | | | | | | | | | | |
| Northern harrier | x | x | x | x | x | x | x | x | | | x | x |
| Cooper's hawk | x | x | x | x | x | x | x | x | | | x | x |
| Red-shouldered hawk | x | x | | x | x | | x | x | | | x | |
| Sharp-shinned hawk | x | x | | x | x | | x | x | | | x | |
| Barn owl | x | x | x | x | x | x | x | x | x | x | x | x |
| Black vulture | x | x | x | x | x | x | x | x | | | x | x |
| Cougar | | | | | | | | | | | | |
| Red fox | x | x | x | x | x | x | x | x | | | x | x |
| Snapping turtle | x | | | | | | x | x | | | x | x |

Table B.6. Summary of habitat availability for assessment and measurment endpoints at Y-12 OUs, Freel's Bend, and the South Campus Facility[a]

| | Bear Creek | BC OU1 | BC OU2 | CR OU1 | CR OU2 | CR OU3 | CR OU4 | LEFPC | UEFPC OU2 | UEFPC OU3 | Freels Bend | SCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black rat snake | x | x | x | x | x | x | x | x | x | x | x | x |
| Northern pine snake | x | x | | x | x | | x | x | | | x | x |
| Total number of endpoints/OU | 49 | 35 | 27 | 35 | 35 | 26 | 48 | 49 | 9 | 9 | 48 | 43 |

[a] X=presence of at least one habitat category prefered by the endpoint. Amount of suitable habitat not considered; only presence/absence of habitat.

**Table B.7. Ranking of endpoint species by the number of OUs that provide at least one favored habitat type**

| Endpoint Species | Total OUs W/habitat | Endpoint Species | Total OUs W/habitat |
|---|---|---|---|
| Barn owl | 37 | American Toad | 24 |
| Groundhog | 37 | Long-tailed shrew | 23 |
| European starling | 37 | Red-shouldered hawk | 23 |
| American robin | 37 | Sharp-shinned hawk | 23 |
| Rafinesque's big-eared bat | 37 | Masked shrew | 23 |
| Raccoon | 37 | Smokey shrew | 23 |
| Eastern cottontail | 37 | Snapping turtle | 16 |
| Black rat snake | 37 | Mallard duck | 16 |
| Canada goose | 37 | Muskrat | 16 |
| American woodcock | 31 | Pied-billed grebe | 16 |
| Henslow's sparrow | 31 | Mink | 16 |
| Southeastern shrew | 31 | Great blue heron | 16 |
| Wild turkey | 31 | Belted kingfisher | 16 |
| Slender glass snake | 31 | Black-crowned night heron | 16 |
| Grasshopper sparrow | 31 | Wood duck | 16 |
| Six-line racerunner | 31 | Northern Water snake | 16 |
| Eastern small footed bat | 31 | Leopard frog | 16 |
| Indiana bat | 31 | Cumberland slider | 16 |
| Lark sparrow | 31 | River otter | 15 |
| Red fox | 31 | Hellbender | 7 |
| Black vulture | 31 | Bald eagle | 3 |
| Cooper's hawk | 31 | Gray bat | 3 |
| Northern harrier | 31 | Double-crested cormorant | 3 |
| White-tailed deer | 31 | Osprey | 3 |
| Red-tailed hawk | 31 | Green salamander | 0 |
| Vesper sparrow | 31 | Golden eagle | 0 |
| Rough-winged swallows | 27 | Tennessee cave salamander | 0 |
| Short-tailed shrew | 24 | Cougar | 0 |
| Northern pine snake | 24 | | |

**Table B.8. Ranking of OUs on the ORR by the number of species for which they provide habitat**

| OUs | Total species per OU | Ous | Total species per OU |
|---|---|---|---|
| WAG 2 | 53 | WAG 9 | 35 |
| K-901 | 52 | WAG 10 | 35 |
| Lower East Fork Poplar Creek | 49 | WAG 11 | 35 |
| Bear Creek | 49 | WAG 13 | 35 |
| WAG 4 | 49 | BC OU1 | 35 |
| WAG 5 | 49 | CR OU1 | 35 |
| WAG 6 | 49 | CR OU2 | 35 |
| WAG 7 | 49 | BC OU2 | 27 |
| K-33 | 48 | K-1064 | 26 |
| K-770 | 48 | K-1410 | 26 |
| CR OU4 | 48 | K-29 | 26 |
| Freel's Bend | 48 | CR OU3 | 26 |
| WAG 1 | 47 | K-1413 | 9 |
| K-1007 | 44 | K-1004 | 9 |
| South Campus Facility | 43 | K-1401 | 9 |
| K-1407 | 40 | K-1420 | 9 |
| K-1070-C/D | 35 | UEFPC OU2 | 9 |
| WAG 3 | 35 | UEFPC OU3 | 9 |
| WAG 8 | 35 | | |

## Appendix C

## TABLES AND FIGURES FOR CHAPTER 4: ASSESSMENT OF RISK TO PISCIVORES ON THE OAK RIDGE RESERVATION

**Table C.1. Life history parameters for mink**

| Parameter | Value | Comments | Reference |
|---|---|---|---|
| Body Weight | 1.0 kg (mean ♂+♀) | | EPA 1993b |
| Food Consumption Rate | 0.137 kg/d (mean ♂+♀) | | Bleavins and Aulerich 1981 |
| Water Consumption Rate | 0.099 L/d | estimated using allometric equation[a] assuming 1.0 kg bw | After Calder and Braun 1983 |
| Diet Composition | Diverse diet includes: mammals, fish, aquatic invertebrates, amphibians, and birds | | Hamilton 1940, Sealander 1943, Korschgen 1958, Burgess and Bider 1980 Alexander 1977 |
| | Proportion of aquatic prey (fish, amphibians, inverts, etc.) = 0.546±0.21 | Proportion represents means of values from five studies | |
| | fish sizes: 0-10 cm=72% 11-20 cm=28% | | |
| Home Range | 2.63 km (♂) 1.85 km (♀) | stream - Sweden | Gerell 1970 |
| | 770 ha (♂) | prairie potholes, Manitoba | Arnold and Fritzell 1987 |
| | | range size and shape depends on habitat - linear along streams, circular in marshes | EPA 1993a. |
| Habitat Requirements | aquatic habitats - streams, lakes, marshes; | | Burt and Grossenheider 1976 |
| Population Density | 0.03 - 0.085 /ha | river - Montana | Mitchell 1961 |
| | 0.6/km | river - Michigan | EPA 1993a |
| Behavior | nocturnal active year-round, does not hibernate | | EPA 1993a |

[a] Allometric equation for estimation of water consumption by mammals is:

$$W=0.099(bw)^{0.90}$$

where: W = water consumption (L/d)
bw = body weight (kg)

**Table C.2. Life history parameters for river otter**

| Parameter | Value | Comments | Reference |
|---|---|---|---|
| Body Weight | **8.0** kg (mean ♂+♀) | | EPA 1993b |
| Food Consumption Rate | **0.9** kg/d (mean ♂+♀) | | EPA 1993b |
| Water Consumption Rate | **0.64** L/d | | EPA 1993b |
| Diet Composition | Almost exclusively fish 2-50 cm in size; most ≥30 cm. | | Melquist and Hornocker 1983 |
| | 50% large and 50% small fish | | EPA 1993b |
| Home Range | 10-78 km | river-Idaho | Melquist and Hornocker 1983 |
| | | range size and shape depends on habitat - linear along streams, circular in marshes | EPA 1993b |
| Habitat Requirements | aquatic habitats - streams, lakes, marshes; | | EPA 1993b |
| Population Density | 0.17 - 0.37 /km | river-Idaho | Melquist and Hornocker 1983 |
| | 0.0094-0.014/ha | | EPA 1993b |
| Behavior | Generally most active morning and evening, but may be active at any time in day. | | Melquist and Hornocker 1983 |
| | active year-round, does not hibernate | | EPA 1993b |

**Table C-3. Life history parameters for belted kingfisher**

| Parameter | Value | Comments | Reference |
|---|---|---|---|
| Body Weight | 0.148 kg | | Dunning 1984 |
| Food Consumption Rate | 50% bw | | Alexander 1977 |
| | 0.075 kg/d | assuming 0.148 kg bw | |
| Water Consumption Rate | 0.016 L/d | estimated using allometric equation[a] assuming 0.148 kg bw | |
| Soil Consumption Rate | as a piscivore, assumed to be negligible | | |
| Diet Composition | Cyprinids - 76.4%<br>other fish - 10.2%<br>crayfish - 13.3% | Ohio - creek | Davis 1982 |
| | lizards, small snakes, frogs, salamanders, and insects may be consumed if fish are unavailable | | Landrum et al. 1993 |
| Home Range | 1.03 km (breeding)<br>0.39 km (non-breeding) | Ohio - creek | Davis 1982 |
| | 2.19 km (breeding) | Pennsylvania - stream summer | Brooks and Davis 1987 |
| Habitat Requirements | uses a diverse aquatic habitats (stream, river, lake, marsh, coastline) | | Brooks and Davis 1987 |
| | require high vertical banks composed of >75% sand and <7% clay for nest construction | | |
| | prefer relatively clear waters free of thick vegetation | | Bent 1940. |
| Population Density | 0.11 - 0.19 pairs/km shore | Pennsylvania - stream summer | Brooks and Davis 1987 |
| Behavior | while most migrate from northern parts of range, some may stay in areas where water remains ice-free | | Bent 1940. |

[a] Allometric equation for estimation of water consumption by birds is:

$$W=0.059(bw)^{0.67}$$

where: W = water consumption (L/d)
bw = body weight (kg)

**Table C.4. Life history parameters for great blue heron**

| Parameter | Value | Comments | Reference |
|---|---|---|---|
| Body Weight | 2.576 kg (♂)<br>2.204 kg (♀)<br><br>**2.39** kg (mean♂+♀) | | Dunning 1984 |
| Food Consumption Rate | **0.42** kg/d | estimated using allometric equation[a] specific for herons and egrets<br><br>assuming 2.39 kg bw | Kushlan 1978 |
| Water Consumption Rate | **0.1058** L/d | estimated using allometric equation[b] assuming 2.39 kg bw | After Calder and Braun 1983 |
| Diet Composition | diet predominantly fish but may include crustaceans, insects, snails, amphibians, reptiles, birds, and mammals | | Kushlan 1978<br>Collazo 1985<br>Hoffman 1978 |
| | fish sizes:<br>0-10 cm=39.2%<br>11-20 cm=47.1%<br>21-30 cm=13.7% | | Alexander 1977 |
| Home Range (foraging distance from colony) | 3.1 km | up to 24.2 km - S. Dakota - river | EPA 1993a. |
| | 7 - 8 km | N. Carolina - coastal | Short and Cooper 1985 |
| Habitat Requirements | use both coastal and inland water-associated habitats | | Short and Cooper 1985 |
| | Foraging: shallow shores of ponds, lakes, streams, wet meadows, wooded swamps, bays, and marshes | | DeGraaf et al. 1981 |
| | breeding: trees for rookery sites. In absence of trees will use rock ledges, cliffs, and artificial structures | | Short and Cooper 1985 |

# Table C.4. Life history parameters for great blue heron

| Parameter | Value | Comments | Reference |
|---|---|---|---|
| Population Density | nest colonially, therefore population density depends on availability of nest habitat and suitable foraging habitat | | EPA 1993a |
| | 2.3 - 3.6 /km | North Dakota rivers and streams | |
| Behavior | may or may not defend a feeding territory depending on local population size and food availability | | Kushlan 1978 |
| | Migrates in northern U.S. and southern Canada; year round resident from WV, PA south. | | National Geographic Society 1987. |

[a] Allometric equation for estimation of food consumption by herons and egrets is:

$$\log FIR = 0.966 \log bw - 0.640$$

where: FIR = food ingestion rate (g/d)
bw = body weight (g)

[b] Allometric equation for estimation of water consumption by birds is:

$$W = 0.059(bw)^{0.67}$$

where: W = water consumption (L/d)
bw = body weight (kg)

Table C.5. Fillet-to-Whole Fish Ratios from the Clinch River

| Analyte | Ratio |
|---|---|
| Aldrin [a] | 3.8 |
| Aroclor-1016 [a] | 3.8 |
| Aroclor-1221 [a] | 3.8 |
| Aroclor-1232 [a] | 3.8 |
| Aroclor-1242 [a] | 3.8 |
| Aroclor-1254 | 3.8 |
| Aroclor-1260 | 5.46 |
| Benzo(a)pyrene [a] | 3.8 |
| BHC [a] | 3.8 |
| Bis(ethylhexyl)phthalate [a] | 3.8 |
| Chlordane, total | 3.9 |
| DDD [a] | 3.8 |
| DDE [a] | 3.8 |
| DDT [a] | 3.8 |
| Dieldrin [a] | 3.8 |
| Endrin [a] | 3.8 |
| Endosulfan [a] | 3.8 |
| Heptachlor[a] | 3.8 |
| Lindane [a] | 3.8 |
| Methoxychlor [a] | 3.8 |
| Toxaphene [a] | 3.8 |
| Arsenic [c] | 1.4 |
| Antimony [b] | 1 |
| Beryllium [b] | 1 |
| Cadmium [c] | 5.03 |
| Chromium [c] | 1.2 |
| Copper [c] | 6.8 |
| Mercury [c] | 0.68 |
| Selenium [c] | 1.07 |
| Uranium [c] | 7.58 |
| Zinc [c] | 2.46 |

[a] Specific ratios were not available for these contaminants. Because $K_{ow}$s for these chemicals are comparable to that for Aroclor 1254, ratios were also assumed to be comparable.

[b] Specific ratio was not available. Because most inorganics had ratios ~1, assumed 1.

[c] Data from spotted bass from Southworth (1994).

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Antimony | Bear Creek | BCK12.4 | 8 | 2 | <30 cm | 0.0140 | 0.0026 | 0.0018 | 0.0140 | 0.0000 |
| Arsenic | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.4930 | 0.2509 | 0.0468 | 0.4930 | 0.1140 |
| Beryllium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.0510 | 0.0164 | 0.0067 | 0.0510 | 0.0000 |
| Cadmium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 2.7400 | 1.7299 | 0.1872 | 2.7400 | 0.9290 |
| Chromium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 1.1700 | 0.6960 | 0.0934 | 1.1700 | 0.3990 |
| Copper | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 1.1500 | 0.8255 | 0.0599 | 1.1500 | 0.6200 |
| Lead | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 1.1000 | 0.4434 | 0.1165 | 1.1000 | 0.0440 |
| Lithium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.6520 | 0.2376 | 0.0813 | 0.6520 | 0.0260 |
| Mercury | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.1700 | 0.1199 | 0.0099 | 0.1700 | 0.0870 |
| Nickel | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 5.2400 | 2.4488 | 0.5734 | 5.2400 | 0.6800 |
| PCB,total | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.6100 | 0.2750 | 0.0655 | 0.0700 | 0.6100 |
| Selenium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.5380 | 0.4355 | 0.0308 | 0.5380 | 0.3140 |
| Thallium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 0.0120 | 0.0078 | 0.0008 | 0.0120 | 0.0060 |
| Uranium | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 1.2200 | 0.7325 | 0.1077 | 1.2200 | 0.3670 |
| Zinc | Bear Creek | BCK12.4 | 8 | 8 | <30 cm | 43.7000 | 40.4625 | 1.2578 | 43.7000 | 34.1000 |
| Antimony | Bear Creek | BCK9.4 | 8 | 3 | <30 cm | 0.0130 | 0.0021 | 0.0016 | 0.0130 | 0.0000 |
| Arsenic | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.5730 | 0.4333 | 0.0544 | 0.5730 | 0.0930 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Beryllium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.0330 | 0.0198 | 0.0037 | 0.0330 | 0.0010 |
| Cadmium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.6940 | 0.4804 | 0.0603 | 0.6940 | 0.1930 |
| Chromium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.2600 | 0.9748 | 0.0823 | 1.2600 | 0.5440 |
| Copper | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.3000 | 1.0294 | 0.0963 | 1.3000 | 0.4530 |
| Lead | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.8400 | 0.5316 | 0.0911 | 0.8400 | 0.0460 |
| Lithium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.5000 | 0.7559 | 0.1442 | 1.5000 | 0.1100 |
| Mercury | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.1100 | 0.0788 | 0.0058 | 0.1100 | 0.0600 |
| Nickel | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.1900 | 0.8493 | 0.1069 | 1.1900 | 0.2790 |
| PCB,total | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 4.5000 | 2.8550 | 0.4940 | 0.6700 | 4.5000 |
| Selenium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.1200 | 0.6090 | 0.0803 | 1.1200 | 0.3910 |
| Thallium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 0.0290 | 0.0115 | 0.0028 | 0.0290 | 0.0020 |
| Uranium | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 1.4000 | 0.9818 | 0.0923 | 1.4000 | 0.5210 |
| Zinc | Bear Creek | BCK9.4 | 8 | 8 | <30 cm | 59.2000 | 48.3125 | 2.8416 | 59.2000 | 36.7000 |
| Mercury | Bear Creek | BCK4.5 | 36 | 36 | <30 cm | 0.3779 | 0.3264 | 0.0305 | 0.0816 | 0.8020 |
| PCB-1254 | Bear Creek | BCK4.5 | 36 | 33 | <30 cm | 1.6763 | 1.2753 | 0.2371 | 0.0381 | 5.7150 |
| PCB-1260 | Bear Creek | BCK4.5 | 36 | 36 | <30 cm | 3.5360 | 2.5965 | 0.5561 | 0.1092 | 16.3250 |
| Antimony | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.0070 | 0.0035 | 0.0008 | 0.0070 | 0.0004 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Arsenic | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.4010 | 0.3123 | 0.0331 | 0.4010 | 0.1130 |
| Beryllium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.0240 | 0.0109 | 0.0030 | 0.0240 | 0.0020 |
| Cadmium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.3150 | 0.1936 | 0.0262 | 0.3150 | 0.0870 |
| Chromium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 1.1200 | 0.7934 | 0.0718 | 1.1200 | 0.6160 |
| Copper | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 1.1400 | 1.0038 | 0.0391 | 1.1400 | 0.7770 |
| Lead | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.5200 | 0.2260 | 0.0572 | 0.5200 | 0.0650 |
| Lithium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.6690 | 0.3356 | 0.0794 | 0.6690 | 0.0980 |
| Mercury | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.0860 | 0.0600 | 0.0059 | 0.0860 | 0.0400 |
| Nickel | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.8960 | 0.5743 | 0.0747 | 0.8960 | 0.3380 |
| PCB,total | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 1.7500 | 0.9775 | 0.1500 | 0.4800 | 1.7500 |
| Selenium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.7860 | 0.5640 | 0.0444 | 0.7860 | 0.4230 |
| Thallium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.0100 | 0.0058 | 0.0009 | 0.0100 | 0.0030 |
| Uranium | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 0.5570 | 0.4154 | 0.0405 | 0.5570 | 0.2330 |
| Zinc | Bear Creek | BCK3.3 | 8 | 8 | <30 cm | 81.4000 | 57.8750 | 4.1847 | 81.4000 | 41.7000 |
| Mercury | Bear Creek | BCK0.6 | 105 | 105 | <30 cm | 0.3360 | 0.3144 | 0.0131 | 0.0612 | 0.8228 |
| PCB-1254 | Bear Creek | BCK0.6 | 105 | 89 | <30 cm | 0.4895 | 0.3846 | 0.0631 | 0.0381 | 5.7150 |
| PCB-1260 | Bear Creek | BCK0.6 | 105 | 101 | <30 cm | 0.7964 | 0.6490 | 0.0888 | 0.0546 | 6.0060 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Mercury | East Fork | EFK24.8 | 24 | 24 | <30 cm | 1.2226 | 1.1277 | 0.0554 | 0.7480 | 1.7750 |
| PCB-1254 | East Fork | EFK24.8 | 24 | 23 | <30 cm | 2.6695 | 2.1304 | 0.3114 | 0.0381 | 5.3720 |
| PCB-1260 | East Fork | EFK24.8 | 24 | 24 | <30 cm | 21.3933 | 12.3646 | 5.2680 | 1.0920 | 129.4020 |
| Aldrin | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BHC | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0109 | 0.0079 | 0.0015 | 0.0036 | 0.0122 |
| BHC, total | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0004 | 0.0002 | 0.0002 | 0.0000 | 0.0009 |
| Chlordane | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.1741 | 0.1393 | 0.0173 | 0.0741 | 0.1886 |
| DDT, total | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0661 | 0.0554 | 0.0053 | 0.0385 | 0.0714 |
| Dieldrin | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0308 | 0.0232 | 0.0038 | 0.0112 | 0.0348 |
| Endrin | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Endrin | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MIREX | East Fork | EFK24.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mercury | East Fork | EFK24.4 | 6 | 6 | <30 cm | 3.4840 | 2.7452 | 0.3667 | 1.9400 | 3.9762 |
| PCB,total | East Fork | EFK24.4 | 6 | 6 | <30 cm | 8.0821 | 7.1066 | 0.4841 | 5.4933 | 8.4350 |
| Mercury | East Fork | EFK24 | 24 | 24 | <30 cm | 0.4502 | 0.3953 | 0.0320 | 0.1360 | 0.8160 |
| PCB-1254 | East Fork | EFK24 | 24 | 22 | <30 cm | 1.6639 | 1.1763 | 0.2813 | 0.0381 | 5.7910 |
| PCB-1260 | East Fork | EFK24 | 24 | 23 | <30 cm | 3.4712 | 2.4342 | 0.6045 | 0.0546 | 12.5030 |

Table C.6. Summary statistics for fish data from the ORR

| | | | | | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Drainage | Sampling station | N | Detects | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Mercury | East Fork | EFK23.7 | 16 | 16 | <30 cm | 0.4872 | 0.4275 | 0.0341 | 0.2380 | 0.7620 |
| PCB-1254 | East Fork | EFK23.7 | 16 | 16 | <30 cm | 2.2148 | 1.5978 | 0.3520 | 0.0381 | 5.8670 |
| PCB-1260 | East Fork | EFK23.7 | 16 | 16 | <30 cm | 4.9993 | 3.7708 | 0.7008 | 1.1466 | 9.6640 |
| Mercury | East Fork | EFK23.5 | 71 | 71 | <30 cm | 0.4799 | 0.4506 | 0.0176 | 0.0544 | 0.8840 |
| PCB-1254 | East Fork | EFK23.5 | 64 | 62 | <30 cm | 1.2100 | 0.9876 | 0.1332 | 0.0381 | 6.7820 |
| PCB-1260 | East Fork | EFK23.5 | 64 | 63 | <30 cm | 7.2214 | 5.6912 | 0.9161 | 0.0546 | 37.5650 |
| Aldrin | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0009 | 0.0003 | 0.0003 | 0.0000 | 0.0019 |
| BHC | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0082 | 0.0073 | 0.0004 | 0.0058 | 0.0084 |
| BHC, total | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0008 | 0.0004 | 0.0002 | 0.0000 | 0.0013 |
| Chlordane | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.1477 | 0.1138 | 0.0169 | 0.0671 | 0.1555 |
| DDT, total | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0657 | 0.0629 | 0.0014 | 0.0585 | 0.0675 |
| Dieldrin | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0405 | 0.0313 | 0.0046 | 0.0172 | 0.0430 |
| Endrin | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Endrin | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mercury | East Fork | EFK23.4 | 3 | 3 | >30 cm | 0.3131 | 0.1541 | 0.0544 | 0.0748 | 0.2584 |
| Mercury | East Fork | EFK23.4 | 288 | 288 | <30 cm | 0.7246 | 0.6850 | 0.0240 | 0.0272 | 2.4480 |
| MIREX | East Fork | EFK23.4 | 6 | 6 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Mercury | East Fork | EFK23.4 | 6 | 6 | <30 cm | 1.2613 | 0.9217 | 0.1685 | 0.4930 | 1.4700 |
| PCB-1254 | East Fork | EFK23.4 | 231 | 215 | <30 cm | 1.3692 | 1.2052 | 0.0993 | 0.0381 | 11.0490 |
| PCB-1254 | East Fork | EFK23.4 | 1 | 1 | >30 cm | 1.1811 | 1.1811 | 0.0000 | 1.1811 | 1.1811 |
| PCB-1260 | East Fork | EFK23.4 | 1 | 1 | >30 cm | 1.5288 | 1.5288 | 0.0000 | 1.5288 | 1.5288 |
| PCB-1260 | East Fork | EFK23.4 | 1 | 1 | >30 cm | 1.5288 | 1.5288 | 0.0000 | 1.5288 | 1.5288 |
| PCB-1260 | East Fork | EFK23.4 | 231 | 230 | <30 cm | 2.2923 | 2.0304 | 0.1586 | 0.0546 | 17.5270 |
| PCB,total | East Fork | EFK23.4 | 6 | 6 | <30 cm | 6.3142 | 5.5991 | 0.3549 | 4.5398 | 6.6110 |
| Antimony | East Fork | EFPC RI 1[a] | 4 | 1 | <30 cm | 0.0760 | 0.0471 | 0.0228 | 0.0066 | 0.0958 |
| Arsenic | East Fork | EFPC RI 1 | 4 | 2 | <30 cm | 0.3204 | 0.2314 | 0.0474 | 0.1486 | 0.3208 |
| Benzo(a)pyrene | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 0.0276 | 0.0121 | 0.0066 | 0.0004 | 0.0240 |
| Chlordane | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 0.2633 | 0.1438 | 0.0508 | 0.0350 | 0.2400 |
| Chromium | East Fork | EFPC RI 1 | 4 | 3 | <30 cm | 2.8951 | 1.2912 | 0.6430 | 0.2910 | 2.9979 |
| DDE | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 0.2245 | 0.1185 | 0.0450 | 0.0210 | 0.2000 |
| Dieldrin | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 0.1062 | 0.0615 | 0.0190 | 0.0190 | 0.0950 |
| Heptachlor, total | East Fork | EFPC RI 1 | 8 | 8 | <30 cm | 0.2817 | 0.2218 | 0.0316 | 0.1210 | 0.3060 |
| Lindane | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 0.0065 | 0.0041 | 0.0010 | 0.0024 | 0.0060 |
| Mercury | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 3.6382 | 2.1096 | 0.6495 | 0.9004 | 3.7512 |

**Table C.6. Summary statistics for fish data from the ORR**

| | | | | | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Drainage | Sampling station | N | Detects | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1260 | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 9.2285 | 5.3000 | 1.6693 | 1.5000 | 8.3000 |
| Selenium | East Fork | EFPC RI 1 | 4 | 3 | <30 cm | 0.8853 | 0.6509 | 0.1024 | 0.4250 | 0.9160 |
| Uranium | East Fork | EFPC RI 1 | 4 | 2 | <30 cm | 0.9076 | 0.5466 | 0.1789 | 0.1791 | 0.9112 |
| Zinc | East Fork | EFPC RI 1 | 4 | 4 | <30 cm | 90.3683 | 54.2010 | 15.3683 | 23.0600 | 85.5790 |
| Antimony | East Fork | EFPC RI 2 | 3 | 1 | <30 cm | 0.0114 | 0.0311 | 0.0200 | 0.0108 | 0.0712 |
| Arsenic | East Fork | EFPC RI 2 | 3 | 2 | <30 cm | 0.3818 | 0.2893 | 0.0688 | 0.1524 | 0.3703 |
| Benzo(a)pyrene | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 0.0251 | 0.0102 | 0.0051 | 0.0007 | 0.0180 |
| Chlordane | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 0.3569 | 0.1643 | 0.0660 | 0.0329 | 0.2400 |
| Chromium | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 4.9032 | 2.3637 | 0.8697 | 0.6292 | 3.3440 |
| DDE | East Fork | EFPC RI 2 | 3 | 2 | <30 cm | 0.3384 | 0.2250 | 0.1361 | 0.0150 | 0.4800 |
| Dieldrin | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 0.1267 | 0.0630 | 0.0218 | 0.0200 | 0.0910 |
| Heptachlor, total | East Fork | EFPC RI 2 | 6 | 6 | <30 cm | 0.3114 | 0.2352 | 0.0378 | 0.1157 | 0.2960 |
| Lindane | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 0.0060 | 0.0048 | 0.0004 | 0.0044 | 0.0056 |
| Mercury | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 10.7515 | 4.6061 | 2.1046 | 1.0828 | 8.3622 |
| PCB-1260 | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 10.7310 | 5.6333 | 1.7458 | 2.2000 | 7.9000 |
| Selenium | East Fork | EFPC RI 2 | 3 | 2 | <30 cm | 1.0307 | 0.7103 | 0.1045 | 0.5640 | 0.9126 |
| Uranium | East Fork | EFPC RI 2 | 3 | 2 | <30 cm | 0.8444 | 0.5864 | 0.1688 | 0.2532 | 0.8007 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Zinc | East Fork | EFPC RI 2 | 3 | 3 | <30 cm | 93.2484 | 54.3127 | 13.3342 | 27.7020 | 69.1370 |
| Aldrin | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BHC | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0033 | 0.0029 | 0.0002 | 0.0026 | 0.0031 |
| BHC, total | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0006 | 0.0002 | 0.0002 | 0.0000 | 0.0005 |
| Chlordane | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.4386 | 0.3419 | 0.0331 | 0.2800 | 0.3931 |
| DDT, total | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.1177 | 0.0937 | 0.0082 | 0.0817 | 0.1095 |
| Dieldrin | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0591 | 0.0466 | 0.0043 | 0.0389 | 0.0538 |
| Endrin | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Endrin | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MIREX | East Fork | EFK18.4 | 3 | 3 | <30 cm | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| PCB-1254 | East Fork | EFK18.4 | 3 | 3 | <30 cm | 2.7267 | 2.3463 | 0.1303 | 2.0938 | 2.5280 |
| Mercury | East Fork | EFK18.2 | 147 | 147 | <30 cm | 0.6298 | 0.6039 | 0.0157 | 0.2584 | 1.3670 |
| Mercury | East Fork | EFK18.2 | 69 | 69 | >30 cm | 0.5888 | 0.5469 | 0.0251 | 0.0544 | 1.2920 |
| PCB-1254 | East Fork | EFK18.2 | 69 | 68 | >30 cm | 2.1118 | 1.7830 | 0.1972 | 0.0381 | 9.4869 |
| PCB-1254 | East Fork | EFK18.2 | 139 | 130 | <30 cm | 0.4955 | 0.4408 | 0.0331 | 0.0381 | 1.9050 |
| PCB-1260 | East Fork | EFK18.2 | 139 | 138 | <30 cm | 1.3123 | 1.1466 | 0.1001 | 0.0546 | 7.0980 |
| PCB-1260 | East Fork | EFK18.2 | 69 | 69 | >30 cm | 5.2465 | 4.6695 | 0.3460 | 0.1092 | 12.0120 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1260 | East Fork | EFK18.2 | 69 | 69 | >30 cm | 5.2465 | 4.6695 | 0.3460 | 0.1092 | 12.0120 |
| MN_HG | East Fork | EFK18 | 3 | 3 | <30 cm | 0.5329 | 0.4336 | 0.0340 | 0.3910 | 0.5010 |
| Antimony | East Fork | EFPC RI 3 | 4 | 1 | <30 cm | 0.0108 | 0.0100 | 0.0019 | 0.0061 | 0.0148 |
| Arsenic | East Fork | EFPC RI 3 | 4 | 2 | <30 cm | 0.2883 | 0.2102 | 0.0376 | 0.1391 | 0.2892 |
| Benzo(a)pyrene | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 0.0146 | 0.0066 | 0.0034 | 0.0007 | 0.0130 |
| Chlordane | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 0.1131 | 0.0888 | 0.0104 | 0.0610 | 0.1060 |
| Chlordane | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.0331 | 0.0331 | 0.0000 | 0.0331 | 0.0331 |
| Chromium | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 2.4525 | 1.2763 | 0.4998 | 0.4016 | 2.1497 |
| Chromium | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.3710 | 0.3710 | 0.0000 | 0.3710 | 0.3710 |
| DDE | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 0.0633 | 0.0435 | 0.0084 | 0.0250 | 0.0610 |
| DDE | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.0035 | 0.0035 | 0.0000 | 0.0035 | 0.0035 |
| Dieldrin | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.0248 | 0.0248 | 0.0000 | 0.0248 | 0.0248 |
| Dieldrin | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 0.0526 | 0.0403 | 0.0053 | 0.0340 | 0.0560 |
| Heptachlor, total | East Fork | EFPC RI 3 | 8 | 8 | <30 cm | 0.1526 | 0.1393 | 0.0070 | 0.1210 | 0.1650 |
| Lindane | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.0099 | 0.0099 | 0.0000 | 0.0099 | 0.0099 |
| Lindane | East Fork | EFPC RI 3 | 4 | 3 | <30 cm | 0.0044 | 0.0267 | 0.0244 | 0.0014 | 0.1000 |
| Mercury | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 2.4331 | 1.8972 | 0.2278 | 1.3320 | 2.3940 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Mercury | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 1.2003 | 1.2003 | 0.0000 | 1.2003 | 1.2003 |
| PCB-1260 | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 3.8766 | 3.8766 | 0.0000 | 3.8766 | 3.8766 |
| PCB-1260 | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 3.8766 | 3.8766 | 0.0000 | 3.8766 | 3.8766 |
| PCB-1260 | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 3.0327 | 2.3500 | 0.2901 | 1.8000 | 3.1000 |
| Selenium | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 0.5331 | 0.5331 | 0.0000 | 0.5331 | 0.5331 |
| Selenium | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 0.7327 | 0.7027 | 0.0128 | 0.6691 | 0.7310 |
| Uranium | East Fork | EFPC RI 3 | 4 | 2 | <30 cm | 0.5625 | 0.3794 | 0.1022 | 0.1878 | 0.5629 |
| Zinc | East Fork | EFPC RI 3 | 1 | 1 | >30 cm | 25.2863 | 25.2863 | 0.0000 | 25.2863 | 25.2863 |
| Zinc | East Fork | EFPC RI 3 | 4 | 4 | <30 cm | 61.4327 | 43.8025 | 7.4915 | 30.5000 | 58.3100 |
| Mercury | East Fork | EFK13.8 | 85 | 85 | >30 cm | 0.5632 | 0.5214 | 0.0251 | 0.0204 | 1.3600 |
| Mercury | East Fork | EFK13.8 | 159 | 159 | <30 cm | 0.5780 | 0.5506 | 0.0165 | 0.0544 | 1.4960 |
| PCB-1254 | East Fork | EFK13.8 | 137 | 112 | <30 cm | 0.3514 | 0.2976 | 0.0325 | 0.0381 | 2.5150 |
| PCB-1254 | East Fork | EFK13.8 | 80 | 79 | >30 cm | 2.0442 | 1.6316 | 0.2479 | 0.0381 | 16.6497 |
| PCB-1260 | East Fork | EFK13.8 | 80 | 80 | >30 cm | 4.8929 | 4.2547 | 0.3834 | 0.1092 | 14.1960 |
| PCB-1260 | East Fork | EFK13.8 | 80 | 80 | >30 cm | 4.8929 | 4.2547 | 0.3834 | 0.1092 | 14.1960 |
| PCB-1260 | East Fork | EFK13.8 | 137 | 134 | <30 cm | 1.0032 | 0.8561 | 0.0882 | 0.0546 | 6.5520 |
| Aldrin | East Fork | EFPC RI 4 | 4 | 2 | <30 cm | 0.0330 | 0.0375 | 0.0026 | 0.0330 | 0.0420 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Antimony | East Fork | EFPC RI 4 | 4 | 1 | <30 cm | 0.0123 | 0.0084 | 0.0014 | 0.0061 | 0.0123 |
| Benzo(a)pyrene | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 0.0057 | 0.0025 | 0.0014 | 0.0001 | 0.0054 |
| BHC, total | East Fork | EFPC RI 4 | 6 | 4 | <30 cm | 0.2075 | 0.3116 | 0.0659 | 0.2074 | 0.5200 |
| Chlordane | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 0.1111 | 0.0903 | 0.0089 | 0.0700 | 0.1100 |
| Chromium | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 1.5887 | 0.9826 | 0.2576 | 0.3516 | 1.4386 |
| DDE | East Fork | EFPC RI 4 | 4 | 2 | <30 cm | 0.0388 | 0.1068 | 0.0481 | 0.0170 | 0.1900 |
| Dieldrin | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 0.0736 | 0.0408 | 0.0140 | 0.0200 | 0.0790 |
| Heptachlor, total | East Fork | EFPC RI 4 | 5 | 5 | <30 cm | 0.1523 | 0.0896 | 0.0294 | 0.0245 | 0.1560 |
| Lindane | East Fork | EFPC RI 4 | 4 | 3 | <30 cm | 0.0021 | 0.0140 | 0.0120 | 0.0020 | 0.0500 |
| Mercury | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 1.0854 | 0.7887 | 0.1261 | 0.5868 | 1.1438 |
| PCB-1260 | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 1.7740 | 1.2125 | 0.2386 | 0.7900 | 1.8000 |
| Selenium | East Fork | EFPC RI 4 | 4 | 3 | <30 cm | 0.8768 | 0.6987 | 0.0870 | 0.4758 | 0.8978 |
| Uranium | East Fork | EFPC RI 4 | 4 | 2 | <30 cm | 0.3843 | 0.2647 | 0.0533 | 0.1279 | 0.3879 |
| Zinc | East Fork | EFPC RI 4 | 4 | 4 | <30 cm | 49.3535 | 34.9000 | 6.1417 | 20.1380 | 48.7530 |
| Mercury | East Fork | EFK10 | 5 | 5 | >30 cm | 0.9385 | 0.7086 | 0.1079 | 0.4148 | 1.0880 |
| PCB-1254 | East Fork | EFK10 | 5 | 5 | >30 cm | 0.7255 | 0.4496 | 0.1294 | 0.1143 | 0.9144 |
| PCB-1260 | East Fork | EFK10 | 5 | 5 | >30 cm | 2.9147 | 2.1949 | 0.3376 | 1.5288 | 3.2214 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1260 | East Fork | EFK10 | 5 | 5 | >30 cm | 2.9147 | 2.1949 | 0.3376 | 1.5288 | 3.2214 |
| Aldrin | East Fork | EFPC RI 5 | 3 | 1 | <30 cm | 0.0370 | 0.0263 | 0.0053 | 0.0210 | 0.0370 |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.0078 | 0.0031 | 0.0016 | 0.0004 | 0.0060 |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.0004 | 0.0004 | 0.0000 | 0.0004 | 0.0004 |
| BHC, total | East Fork | EFPC RI 5 | 5 | 4 | <30 cm | 0.2084 | 0.2180 | 0.0100 | 0.2076 | 0.2580 |
| Chlordane | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.1183 | 0.0917 | 0.0091 | 0.0780 | 0.1090 |
| Chlordane | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.0485 | 0.0485 | 0.0000 | 0.0485 | 0.0485 |
| Chromium | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.4223 | 0.4223 | 0.0000 | 0.4223 | 0.4223 |
| Chromium | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 1.6688 | 0.6384 | 0.3529 | 0.2304 | 1.3411 |
| DDE | East Fork | EFPC RI 5 | 3 | 1 | <30 cm | 0.0280 | 0.0727 | 0.0223 | 0.0280 | 0.0950 |
| Dieldrin | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.0419 | 0.0419 | 0.0000 | 0.0419 | 0.0419 |
| Dieldrin | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.0894 | 0.0557 | 0.0116 | 0.0330 | 0.0710 |
| Heptachlor, total | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.0870 | 0.0702 | 0.0058 | 0.0600 | 0.0799 |
| Lindane | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.0024 | 0.0024 | 0.0000 | 0.0024 | 0.0024 |
| Lindane | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.0041 | 0.0030 | 0.0004 | 0.0025 | 0.0037 |
| Mercury | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.4908 | 0.4908 | 0.0000 | 0.4908 | 0.4908 |
| Mercury | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.7939 | 0.5566 | 0.0813 | 0.4518 | 0.7166 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1260 | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.9282 | 0.9282 | 0.0000 | 0.9282 | 0.9282 |
| PCB-1260 | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.9282 | 0.9282 | 0.0000 | 0.9282 | 0.9282 |
| PCB-1260 | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 1.1351 | 1.0267 | 0.0371 | 0.9800 | 1.1000 |
| Selenium | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 0.8339 | 0.5017 | 0.1138 | 0.3319 | 0.7178 |
| Selenium | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 0.3011 | 0.3011 | 0.0000 | 0.3011 | 0.3011 |
| Zinc | East Fork | EFPC RI 5 | 3 | 3 | <30 cm | 49.2589 | 28.2383 | 7.1989 | 17.6900 | 41.9990 |
| Zinc | East Fork | EFPC RI 5 | 1 | 1 | >30 cm | 22.4249 | 22.4249 | 0.0000 | 22.4249 | 22.4249 |
| Mercury | East Fork | EFK6.3 | 105 | 105 | >30 cm | 0.5796 | 0.5486 | 0.0187 | 0.0680 | 0.9588 |
| Mercury | East Fork | EFK6.3 | 154 | 154 | <30 cm | 0.4656 | 0.4457 | 0.0120 | 0.1020 | 0.8840 |
| PCB-1254 | East Fork | EFK6.3 | 97 | 95 | >30 cm | 1.3237 | 1.1046 | 0.1319 | 0.0381 | 8.1534 |
| PCB-1254 | East Fork | EFK6.3 | 140 | 122 | <30 cm | 0.3180 | 0.2686 | 0.0298 | 0.0381 | 2.5150 |
| PCB-1260 | East Fork | EFK6.3 | 97 | 96 | >30 cm | 2.9854 | 2.6883 | 0.1781 | 0.0546 | 12.0120 |
| PCB-1260 | East Fork | EFK6.3 | 97 | 96 | >30 cm | 2.9854 | 2.6883 | 0.1781 | 0.0546 | 12.0120 |
| PCB-1260 | East Fork | EFK6.3 | 140 | 138 | <30 cm | 0.5178 | 0.4586 | 0.0358 | 0.0546 | 3.0030 |
| Benzo(a)pyrene | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.0005 | 0.0005 | 0.0000 | 0.0005 | 0.0005 |
| Chlordane | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.0560 | 0.0560 | 0.0000 | 0.0560 | 0.0560 |
| Chromium | East Fork | EFPC RI 6 | 3 | 2 | <30 cm | 0.8135 | 0.4608 | 0.1630 | 0.1583 | 0.7173 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| Dieldrin | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.0430 | 0.0430 | 0.0000 | 0.0430 | 0.0430 |
| Heptachlor, total | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.0480 | 0.0480 | 0.0000 | 0.0480 | 0.0480 |
| Lindane | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.0037 | 0.0037 | 0.0000 | 0.0037 | 0.0037 |
| Mercury | East Fork | EFPC RI 6 | 3 | 3 | <30 cm | 0.4618 | 0.2952 | 0.0570 | 0.1813 | 0.3578 |
| PCB-1260 | East Fork | EFPC RI 6 | 1 | 1 | <30 cm | 0.4700 | 0.4700 | 0.4700 | 0.4700 | |
| Selenium | East Fork | EFPC RI 6 | 3 | 2 | <30 cm | 0.6063 | 0.4274 | 0.0606 | 0.3098 | 0.5114 |
| Zinc | East Fork | EFPC RI 6 | 3 | 3 | <30 cm | 36.1695 | 21.6793 | 4.9624 | 13.6440 | 30.7420 |
| Mercury | East Fork | EFK2.1 | 15 | 15 | >30 cm | 0.4641 | 0.4017 | 0.0354 | 0.0680 | 0.6188 |
| Mercury | East Fork | EFK2.1 | 285 | 285 | <30 cm | 0.2909 | 0.2787 | 0.0074 | 0.0272 | 0.7820 |
| PCB-1254 | East Fork | EFK2.1 | 266 | 236 | <30 cm | 0.3326 | 0.2949 | 0.0229 | 0.0381 | 3.5810 |
| PCB-1254 | East Fork | EFK2.1 | 13 | 13 | >30 cm | 0.5292 | 0.3869 | 0.0799 | 0.0381 | 0.8382 |
| PCB-1260 | East Fork | EFK2.1 | 13 | 13 | >30 cm | 4.4971 | 3.1080 | 0.7794 | 0.3276 | 8.7360 |
| PCB-1260 | East Fork | EFK2.1 | 266 | 244 | <30 cm | 0.4845 | 0.4265 | 0.0351 | 0.0546 | 6.0060 |
| PCB-1260 | East Fork | EFK2.1 | 13 | 13 | >30 cm | 4.4971 | 3.1080 | 0.7794 | 0.3276 | 8.7360 |
| Mercury | East Fork | EFK2 | 15 | 15 | <30 cm | 0.3854 | 0.3178 | 0.0384 | 0.1360 | 0.6460 |
| PCB-1254 | K-25 | PCK18.2 | 8 | 7 | <30 cm | 0.3412 | 0.2048 | 0.0713 | 0.0381 | 0.5334 |
| PCB-1260 | K-25 | PCK18.2 | 8 | 4 | <30 cm | 0.2990 | 0.1638 | 0.0661 | 0.0546 | 0.4914 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Mercury | K-25 | PCK18.2 | 8 | 8 | <30 cm | 0.0520 | 0.0400 | 0.0064 | 0.0272 | 0.0816 |
| Mercury | K-25 | PCK10.4 | 26 | 26 | <30 cm | 0.1168 | 0.0837 | 0.0194 | 0.0204 | 0.4216 |
| PCB-1254 | K-25 | PCK10.4 | 16 | 14 | <30 cm | 0.1509 | 0.1024 | 0.0275 | 0.0381 | 0.4950 |
| PCB-1260 | K-25 | PCK10.4 | 16 | 12 | <30 cm | 0.2401 | 0.1604 | 0.0450 | 0.0546 | 0.7100 |
| Mercury | K-25 | PCK8.2 | 57 | 57 | <30 cm | 0.3096 | 0.2831 | 0.0158 | 0.0476 | 0.5984 |
| PCB-1254 | K-25 | PCK8.2 | 48 | 32 | <30 cm | 0.3469 | 0.2461 | 0.0598 | 0.0381 | 1.8669 |
| PCB-1260 | K-25 | PCK8.2 | 48 | 45 | <30 cm | 0.3541 | 0.2935 | 0.0361 | 0.0546 | 1.3104 |
| Mercury | K-25 | MIK0.2 | 54 | 54 | <30 cm | 0.1837 | 0.1672 | 0.0098 | 0.0612 | 0.3808 |
| PCB-1254 | K-25 | MIK0.2 | 41 | 40 | <30 cm | 3.0947 | 2.5239 | 0.3381 | 0.0381 | 10.4010 |
| PCB-1260 | K-25 | MIK0.2 | 41 | 40 | <30 cm | 2.5914 | 1.9070 | 0.4044 | 0.0546 | 16.6530 |
| Mercury | K-25 | PCK6.9 | 68 | 68 | <30 cm | 0.3032 | 0.2804 | 0.0137 | 0.0340 | 0.5100 |
| PCB-1254 | K-25 | PCK6.9 | 59 | 45 | <30 cm | 0.3333 | 0.2641 | 0.0413 | 0.0381 | 1.9050 |
| PCB-1260 | K-25 | PCK6.9 | 59 | 56 | <30 cm | 0.6586 | 0.5488 | 0.0657 | 0.0546 | 2.0748 |
| Mercury | K-25 | PCK1.6 | 32 | 32 | <30 cm | 0.1699 | 0.1454 | 0.0145 | 0.0408 | 0.3060 |
| PCB-1254 | K-25 | PCK1.6 | 24 | 24 | <30 cm | 0.4390 | 0.3318 | 0.0626 | 0.0381 | 1.4100 |
| PCB-1260 | K-25 | PCK1.6 | 24 | 23 | <30 cm | 0.5121 | 0.4004 | 0.0651 | 0.0546 | 1.5290 |
| Arsenic | K-25 | K-901 | 4 | 4 | <30 cm | | 0.3675 | 0.7587 | 0.2100 | 0.4600 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| Cadmium | K-25 | K-901 | 1 | 1 | >30 cm | | 0.2515 | ERR | 0.2515 | 0.2515 |
| Chromium | K-25 | K-901 | 8 | 8 | <30 cm | | 15.2950 | 4.6919 | 0.9600 | 44.6000 |
| Chromium | K-25 | K-901 | 1 | 1 | >30 cm | | 0.2760 | ERR | 0.2760 | 0.2760 |
| Copper | K-25 | K-901 | 11 | 11 | >30 cm | | 2.1080 | 0.1645 | 1.4960 | 2.9920 |
| Copper | K-25 | K-901 | 8 | 8 | <30 cm | | 1.1938 | 0.1408 | 0.8500 | 2.1000 |
| Lead | K-25 | K-901 | 9 | 9 | >30 cm | | 0.6333 | 0.1101 | 0.3000 | 1.3800 |
| Lead | K-25 | K-901 | 7 | 7 | <30 cm | | 0.4100 | 0.0421 | 0.2700 | 0.5200 |
| Manganese | K-25 | K-901 | 2 | 2 | >30 cm | | 0.9950 | 0.1050 | 0.8900 | 1.1000 |
| Manganese | K-25 | K-901 | 8 | 8 | <30 cm | | 14.4625 | 1.9148 | 3.7000 | 20.0000 |
| Mercury | K-25 | K-901 | 8 | 8 | <30 cm | | 0.0350 | 0.0038 | 0.0200 | 0.0500 |
| Mercury | K-25 | K-901 | 18 | 18 | >30 cm | | 0.2070 | 0.0414 | 0.0748 | 0.7480 |
| Mercury | K-25 | K-1007 | 1 | 1 | >30 cm | 0.0340 | 0.0340 | 0.0000 | 0.0340 | 0.0340 |
| Mercury | K-25 | K-1007 | 15 | 15 | <30 cm | 0.0552 | 0.0476 | 0.0043 | 0.0204 | 0.0680 |
| Mercury | K-25 | K-710 | 8 | 8 | <30 cm | 0.0909 | 0.0808 | 0.0054 | 0.0612 | 0.1020 |
| Nickel | K-25 | K-901 | 3 | 3 | <30 cm | | 0.9767 | 0.3155 | 0.5800 | 1.6000 |
| PCB-1254 | K-25 | K-710 | 4 | 4 | >30 cm | 0.6151 | 0.4001 | 0.0914 | 0.2286 | 0.6096 |
| PCB-1254 | K-25 | K-1007 | 3 | 2 | <30 cm | 0.1317 | 0.0762 | 0.0220 | 0.0381 | 0.1140 |

## Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1254 | K-25 | K-1007 | 7 | 6 | >30 cm | 46.9397 | 21.3197 | 13.0002 | 0.0381 | 96.8502 |
| PCB-1260 | K-25 | K-1007 | 3 | 1 | <30 cm | 0.2184 | 0.1092 | 0.0546 | 0.0546 | 0.2180 |
| PCB-1260 | K-25 | K-1007 | 7 | 6 | >30 cm | 46.0656 | 20.8416 | 12.7768 | 0.0546 | 95.5500 |
| PCB-1260 | K-25 | K-1007 | 7 | 6 | >30 cm | 46.0656 | 20.8416 | 12.7768 | 0.0546 | 95.5500 |
| PCB-1260 | K-25 | K-901 | 9 | 9 | >30 cm | | 2.4024 | 0.8010 | 0.8190 | 7.0980 |
| PCB-1260 | K-25 | K-710 | 4 | 4 | >30 cm | 2.9298 | 1.3787 | 0.6591 | 0.4368 | 3.3306 |
| PCB-1260 | K-25 | K-710 | 4 | 4 | >30 cm | 2.9298 | 1.3787 | 0.6591 | 0.4368 | 3.3306 |
| PCB-1260 | K-25 | K-901 | 8 | 8 | <30 cm | | 6.2125 | 1.4490 | 2.3000 | 15.0000 |
| Selenium | K-25 | K-901 | 13 | 13 | >30 cm | | 0.4848 | 0.0518 | 0.3210 | 0.9737 |
| Selenium | K-25 | K-901 | 8 | 8 | <30 cm | | 0.3988 | 0.0368 | 0.2900 | 0.6000 |
| Zinc | K-25 | K-901 | 18 | 18 | >30 cm | | 19.1197 | 1.5872 | 11.3160 | 34.9320 |
| Zinc | K-25 | K-901 | 8 | 8 | <30 cm | | 20.5750 | 1.8132 | 16.8000 | 32.5000 |
| Mercury | White Oak | NTK0.2 | 64 | 64 | <30 cm | 0.1279 | 0.1155 | 0.0074 | 0.0068 | 0.2720 |
| PCB-1254 | White Oak | NTK0.2 | 48 | 36 | <30 cm | 0.7372 | 0.5231 | 0.1272 | 0.0381 | 4.0010 |
| PCB-1260 | White Oak | NTK0.2 | 48 | 39 | <30 cm | 0.6617 | 0.4334 | 0.1357 | 0.0546 | 5.1320 |
| Mercury | White Oak | WCK3.5 | 65 | 65 | <30 cm | 0.1824 | 0.1670 | 0.0093 | 0.0408 | 0.3944 |
| Mercury | White Oak | WCK3.5 | 3 | 3 | >30 cm | 0.2256 | 0.2017 | 0.0082 | 0.1904 | 0.2176 |

Table C.6. Summary statistics for fish data from the ORR

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1254 | White Oak | WCK3.5 | 3 | 3 | >30 cm | 2.6147 | 1.1430 | 0.5040 | 0.3810 | 2.0955 |
| PCB-1254 | White Oak | WCK3.5 | 57 | 57 | <30 cm | 1.8184 | 1.4251 | 0.2352 | 0.1143 | 8.4582 |
| PCB-1260 | White Oak | WCK3.5 | 3 | 3 | >30 cm | 1.0513 | 0.7280 | 0.1107 | 0.5460 | 0.9282 |
| PCB-1260 | White Oak | WCK3.5 | 3 | 3 | >30 cm | 1.0513 | 0.7280 | 0.1107 | 0.5460 | 0.9282 |
| PCB-1260 | White Oak | WCK3.5 | 57 | 57 | <30 cm | 1.0715 | 0.8458 | 0.1350 | 0.0546 | 6.0060 |
| Mercury | White Oak | WCK2.9 | 79 | 79 | <30 cm | 0.3032 | 0.2843 | 0.0113 | 0.1020 | 0.4896 |
| PCB-1254 | White Oak | WCK2.9 | 119 | 114 | <30 cm | 1.2562 | 1.0751 | 0.1092 | 0.0381 | 6.4770 |
| PCB-1260 | White Oak | WCK2.9 | 119 | 111 | <30 cm | 1.2435 | 0.9456 | 0.1796 | 0.0546 | 19.6560 |
| Mercury | White Oak | MEK0.2 | 56 | 56 | <30 cm | 0.0910 | 0.0816 | 0.0056 | 0.0340 | 0.2652 |
| PCB-1254 | White Oak | MEK0.2 | 44 | 32 | <30 cm | 0.7278 | 0.4996 | 0.1352 | 0.0381 | 4.5720 |
| PCB-1260 | White Oak | MEK0.2 | 44 | 36 | <30 cm | 0.5186 | 0.3686 | 0.0890 | 0.0546 | 2.6210 |
| Mercury | White Oak | WCK2.3 | 64 | 64 | <30 cm | 0.1973 | 0.1780 | 0.0116 | 0.0340 | 0.4964 |
| PCB-1254 | White Oak | WCK2.3 | 56 | 51 | <30 cm | 1.1605 | 0.9682 | 0.1134 | 0.0381 | 3.8481 |
| PCB-1260 | White Oak | WCK2.3 | 56 | 56 | <30 cm | 1.3191 | 1.0218 | 0.1777 | 0.1638 | 8.4630 |
| Mercury | White Oak | WOL | 65 | 65 | <30 cm | 0.1164 | 0.1037 | 0.0076 | 0.0204 | 0.3060 |
| Mercury | White Oak | WOL | 55 | 55 | >30 cm | 0.2663 | 0.2355 | 0.0184 | 0.0476 | 0.4828 |
| PCB-1254 | White Oak | WOL | 105 | 101 | <30 cm | 1.1031 | 0.9474 | 0.0938 | 0.0381 | 4.5720 |

**Table C.6. Summary statistics for fish data from the ORR**

| Analyte | Drainage | Sampling station | N | Detects | Contaminant concentrations in fish (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fish size | 95% UCB | Mean | Standard error | Minimum | Maximum |
| PCB-1254 | White Oak | WOL | 54 | 54 | >30 cm | 8.5336 | 6.4975 | 1.2162 | 0.2667 | 45.4533 |
| PCB-1260 | White Oak | WOL | 54 | 54 | >30 cm | 5.9626 | 4.7421 | 0.7290 | 0.3276 | 25.0614 |
| PCB-1260 | White Oak | WOL | 54 | 54 | >30 cm | 5.9626 | 4.7421 | 0.7290 | 0.3276 | 25.0614 |
| PCB-1260 | White Oak | WOL | 105 | 104 | <30 cm | 1.7266 | 1.4399 | 0.1727 | 0.0546 | 12.0120 |
| Mercury | White Oak | WCK0.9 | 56 | 56 | <30 cm | 0.0741 | 0.0667 | 0.0045 | 0.0204 | 0.1632 |
| PCB-1254 | White Oak | WCK0.9 | 47 | 44 | <30 cm | 1.0569 | 0.7993 | 0.1534 | 0.0381 | 6.0960 |
| PCB-1260 | White Oak | WCK0.9 | 47 | 42 | <30 cm | 0.6983 | 0.5623 | 0.0809 | 0.0546 | 2.2386 |
| Mercury | White Oak | WCK0.3 | 8 | 8 | <30 cm | 0.1275 | 0.1063 | 0.0112 | 0.0748 | 0.1768 |
| PCB-1254 | White Oak | WCK0.3 | 8 | 8 | <30 cm | 0.8823 | 0.5334 | 0.1841 | 0.1143 | 1.7145 |
| PCB-1260 | White Oak | WCK0.3 | 8 | 8 | <30 cm | 0.7725 | 0.4709 | 0.1592 | 0.0546 | 1.5288 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

Table C.7. Summary statistics for fish data from off-site locations

| Analyte | Drainage | Source | N | Detects | Fish size | Contaminant concentrations in fish (mg/kg) 95% UCB | Mean | Standard error | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | Beaver Creek | BMAP | 5 | 5 | <30 cm | 0.0573 | 0.0408 | 0.00775 | 0.0272 | 0.068 |
| Mercury | Brushy Fork | BMAP | 10 | 10 | <30 cm | 0.0815 | 0.0592 | 0.01217 | 0.0272 | 0.163 |
| Mercury | Hinds Creek | BMAP | 330 | 330 | <30 cm | 0.06562 | 0.06221 | 0.00207 | 0 | 0.3604 |
| Mercury | Hinds Creek | BCV | 8 | 8 | <30 cm | 0.021 | 0.013 | 0.0015 | 0.009 | 0.021 |
| Mercury | Hinds Creek | EFPC | 3 | 3 | <30 cm | 0.05706 | 0.0448 | 0.0042 | 0.037 | 0.0514 |
| Mercury | Brushy Fork | BMAP | 7 | 7 | >30cm | 0.15 | 0.1156 | 0.0177 | 0.0476 | 0.1768 |
| Mercury | Hinds Creek | BMAP | 59 | 59 | >30cm | 0.1601 | 0.1476 | 0.0075 | 0.0476 | 0.3196 |
| PCB-1254 | Brushy Fork | BMAP | 12 | 12 | <30 cm | 3.1986 | 2.1082 | 0.60715 | 0.381 | 6.858 |
| PCB-1260 | Brushy Fork | BMAP | 12 | 12 | <30 cm | 1.7291 | 0.9691 | 0.42315 | 0.546 | 5.624 |
| PCB-1254 | Hinds Creek | BMAP | 322 | 218 | <30 cm | 0.1342 | 0.1296 | 0.00985 | 0 | 1.143 |
| PCB-1260 | Hinds Creek | BMAP | 322 | 139 | <30 cm | 0.0442 | 0.0683 | 0.00356 | 0 | 0.546 |
| PCB,total | Hinds Creek | EFPC | 3 | 3 | <30 cm | 0.0193 | 0.0169 | 0.00082 | 0.0154 | 0.018 |
| PCB-1254 | Brushy Fork | BMAP | 7 | 7 | >30cm | 14.8384 | 6.7002 | 4.1881 | 0.5715 | 31.623 |
| PCB-1260 | Brushy Fork | BMAP | 7 | 7 | >30cm | 3.5881 | 2.1372 | 0.7467 | 0.3822 | 6.006 |
| PCB-1254 | Hinds Creek | BMAP | 56 | 38 | >30cm | 0.1058 | 0.0837 | 0.0131 | 0.0381 | 0.6858 |
| PCB-1260 | Hinds Creek | BMAP | 56 | 53 | >30cm | 1.3237 | 0.7829 | 0.3231 | 0.0546 | 17.472 |
| Chromium | Hinds Creek | BCV | 8 | 8 | <30 cm | 1.02 | 0.719 | 0.082 | 0.382 | 1.02 |

**Table C.7. Summary statistics for fish data from off-site locations**

| | | | | | | Contaminant concentrations in fish (mg/kg) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DDT,total | Hinds Creek | EFPC | 3 | 3 | <30 cm | 0.00714 | 0.00566 | 0.00051 | 0.00507 | 0.0067 |
| Selenium | Hinds Creek | BCV | 8 | 8 | <30 cm | 0.452 | 0.419 | 0.009 | 0.379 | 0.452 |
| Cadmium | Hinds Creek | BCV | 8 | 8 | <30 cm | 0.028 | 0.023 | 0.002 | 0.015 | 0.028 |

**Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK12.4 | 0.0010 | 0.03 | 0.00 |
| Arsenic | Bear Creek | BCK12.4 | 0.0369 | 0.92 | 0.09 |
| Beryllium | Bear Creek | BCK12.4 | 0.0038 | 0.01 | |
| Cadmium | Bear Creek | BCK12.4 | 0.2050 | 34.16 | 29.28 |
| Chromium | Bear Creek | BCK12.4 | 0.0875 | 0.04 | 0.01 |
| Copper | Bear Creek | BCK12.4 | 0.0860 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK12.4 | 0.0823 | 0.01 | 0.00 |
| Lithium | Bear Creek | BCK12.4 | 0.0488 | 0.01 | 0.00 |
| Mercury | Bear Creek | BCK12.4 | 0.0127 | 0.85 | 0.12 |
| Nickel | Bear Creek | BCK12.4 | 0.3920 | 0.01 | 0.01 |
| Selenium | Bear Creek | BCK12.4 | 0.0402 | 1.68 | 0.17 |
| Thallium | Bear Creek | BCK12.4 | 0.0009 | 0.18 | 0.02 |
| Uranium | Bear Creek | BCK12.4 | 0.0913 | 0.10 | 0.05 |
| Zinc | Bear Creek | BCK12.4 | 3.2688 | 0.03 | 0.01 |
| Antimony | Bear Creek | BCK9.4 | 0.0010 | 0.02 | 0.00 |
| Arsenic | Bear Creek | BCK9.4 | 0.0429 | 1.07 | 0.11 |
| Beryllium | Bear Creek | BCK9.4 | 0.0025 | 0.01 | |
| Cadmium | Bear Creek | BCK9.4 | 0.0519 | 8.65 | 7.42 |
| Chromium | Bear Creek | BCK9.4 | 0.0943 | 0.04 | 0.01 |
| Copper | Bear Creek | BCK9.4 | 0.0972 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK9.4 | 0.0628 | 0.01 | 0.00 |
| Lithium | Bear Creek | BCK9.4 | 0.1122 | 0.02 | 0.01 |
| Mercury | Bear Creek | BCK9.4 | 0.0082 | 0.55 | 0.07 |
| Nickel | Bear Creek | BCK9.4 | 0.0890 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK9.4 | 0.0838 | 3.49 | 0.35 |
| Thallium | Bear Creek | BCK9.4 | 0.0022 | 0.43 | 0.04 |
| Uranium | Bear Creek | BCK9.4 | 0.1047 | 0.11 | 0.06 |
| Zinc | Bear Creek | BCK9.4 | 4.4283 | 0.04 | 0.02 |
| Mercury | Bear Creek | BCK4.5 | 0.0283 | 1.88 | 0.26 |

Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK3.3 | 0.0005 | 0.01 | 0.00 |
| Arsenic | Bear Creek | BCK3.3 | 0.0300 | 0.75 | 0.07 |
| Beryllium | Bear Creek | BCK3.3 | 0.0018 | 0.00 | |
| Cadmium | Bear Creek | BCK3.3 | 0.0236 | 3.93 | 3.37 |
| Chromium | Bear Creek | BCK3.3 | 0.0838 | 0.04 | 0.01 |
| Copper | Bear Creek | BCK3.3 | 0.0853 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK3.3 | 0.0389 | 0.01 | 0.00 |
| Lithium | Bear Creek | BCK3.3 | 0.0500 | 0.01 | 0.00 |
| Mercury | Bear Creek | BCK3.3 | 0.0064 | 0.43 | 0.06 |
| Nickel | Bear Creek | BCK3.3 | 0.0670 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK3.3 | 0.0588 | 2.45 | 0.24 |
| Thallium | Bear Creek | BCK3.3 | 0.0007 | 0.15 | 0.01 |
| Uranium | Bear Creek | BCK3.3 | 0.0417 | 0.04 | 0.02 |
| Zinc | Bear Creek | BCK3.3 | 6.0889 | 0.05 | 0.03 |
| Mercury | Bear Creek | BCK0.6 | 0.0251 | 1.68 | 0.23 |
| Mercury | East Fork | EFK24.8 | 0.0915 | 6.10 | 0.83 |
| Aldrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| BHC, total | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK24.4 | 0.0130 | 0.01 | 0.00 |
| DDT, total | East Fork | EFK24.4 | 0.0049 | 0.01 | 0.00 |
| Dieldrin | East Fork | EFK24.4 | 0.0023 | 0.16 | 0.02 |
| Endrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| MN_HG | East Fork | EFK24.4 | 0.2606 | 17.37 | 2.37 |
| Mercury | East Fork | EFK24 | 0.0337 | 2.25 | 0.31 |
| Mercury | East Fork | EFK23.7 | 0.0364 | 2.43 | 0.33 |
| Mercury | East Fork | EFK23.5 | 0.0359 | 2.39 | 0.33 |
| Aldrin | East Fork | EFK23.4 | 0.0001 | 0.00 | 0.00 |
| BHC | East Fork | EFK23.4 | 0.0006 | 0.04 | 0.00 |
| BHC, total | East Fork | EFK23.4 | 0.0001 | 0.00 | 0.00 |

Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Chlordane | East Fork | EFK23.4 | 0.0110 | 0.01 | 0.00 |
| DDT, total | East Fork | EFK23.4 | 0.0049 | 0.01 | 0.00 |
| Dieldrin | East Fork | EFK23.4 | 0.0030 | 0.22 | 0.02 |
| Endrin | East Fork | EFK23.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK23.4 | 0.0943 | 6.29 | 0.86 |
| Antimony | East Fork | EFPC RI 1[a] | 0.0057 | 0.14 | 0.01 |
| Arsenic | East Fork | EFPC RI 1 | 0.0240 | 0.60 | 0.06 |
| Benzo(a)pyrene | East Fork | EFPC RI 1 | 0.0021 | 0.01 | 0.00 |
| Chlordane | East Fork | EFPC RI 1 | 0.0197 | 0.01 | 0.01 |
| Chromium | East Fork | EFPC RI 1 | 0.2166 | 0.09 | 0.02 |
| DDE | East Fork | EFPC RI 1 | 0.0168 | 0.03 | 0.01 |
| Dieldrin | East Fork | EFPC RI 1 | 0.0079 | 0.57 | 0.06 |
| Heptachlor, total | East Fork | EFPC RI 1 | 0.0211 | 0.21 | 0.02 |
| Lindane | East Fork | EFPC RI 1 | 0.0005 | 0.00 | |
| Mercury | East Fork | EFPC RI 1 | 0.2721 | 18.14 | 2.47 |
| Selenium | East Fork | EFPC RI 1 | 0.0662 | 2.76 | 0.28 |
| Uranium | East Fork | EFPC RI 1 | 0.0679 | 0.07 | 0.04 |
| Zinc | East Fork | EFPC RI 1 | 6.7597 | 0.06 | 0.03 |
| Antimony | East Fork | EFPC RI 2 | 0.0009 | 0.02 | 0.00 |
| Arsenic | East Fork | EFPC RI 2 | 0.0286 | 0.71 | 0.07 |
| Benzo(a)pyrene | East Fork | EFPC RI 2 | 0.0019 | 0.01 | 0.00 |
| Chlordane | East Fork | EFPC RI 2 | 0.0267 | 0.02 | 0.01 |
| Chromium | East Fork | EFPC RI 2 | 0.3668 | 0.16 | 0.04 |
| DDE | East Fork | EFPC RI 2 | 0.0253 | 0.04 | 0.01 |
| Dieldrin | East Fork | EFPC RI 2 | 0.0095 | 0.68 | 0.07 |
| Heptachlor, total | East Fork | EFPC RI 2 | 0.0233 | 0.23 | 0.02 |
| Lindane | East Fork | EFPC RI 2 | 0.0004 | 0.00 | |

Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Mercury | East Fork | EFPC RI 2 | 0.8042 | 53.62 | 7.31 |
| Selenium | East Fork | EFPC RI 2 | 0.0771 | 3.21 | 0.32 |
| Uranium | East Fork | EFPC RI 2 | 0.0632 | 0.07 | 0.03 |
| Zinc | East Fork | EFPC RI 2 | 6.9752 | 0.06 | 0.03 |
| Aldrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| BHC, total | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK18.4 | 0.0328 | 0.02 | 0.01 |
| DDT, total | East Fork | EFK18.4 | 0.0088 | 0.02 | 0.00 |
| Dieldrin | East Fork | EFK18.4 | 0.0044 | 0.32 | 0.03 |
| Endrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK18.2 | 0.0471 | 3.14 | 0.43 |
| MN_HG | East Fork | EFK18 | 0.0399 | 2.66 | 0.36 |
| Antimony | East Fork | EFPC RI 3 | 0.0008 | 0.02 | 0.00 |
| Arsenic | East Fork | EFPC RI 3 | 0.0216 | 0.54 | 0.05 |
| Benzo(a)pyrene | East Fork | EFPC RI 3 | 0.0011 | 0.00 | 0.00 |
| Chlordane | East Fork | EFPC RI 3 | 0.0085 | 0.01 | 0.00 |
| Chromium | East Fork | EFPC RI 3 | 0.1835 | 0.08 | 0.02 |
| DDE | East Fork | EFPC RI 3 | 0.0047 | 0.01 | 0.00 |
| Dieldrin | East Fork | EFPC RI 3 | 0.0039 | 0.28 | 0.03 |
| Heptachlor, total | East Fork | EFPC RI 3 | 0.0114 | 0.11 | 0.01 |
| Lindane | East Fork | EFPC RI 3 | 0.0003 | 0.00 | |
| Mercury | East Fork | EFPC RI 3 | 0.1820 | 12.13 | 1.65 |
| Selenium | East Fork | EFPC RI 3 | 0.0548 | 2.28 | 0.23 |
| Uranium | East Fork | EFPC RI 3 | 0.0421 | 0.04 | 0.02 |
| Zinc | East Fork | EFPC RI 3 | 4.5953 | 0.04 | 0.02 |
| Mercury | East Fork | EFK13.8 | 0.0432 | 2.88 | 0.39 |
| Aldrin | East Fork | EFPC RI 4 | 0.0025 | 0.02 | 0.00 |
| Antimony | East Fork | EFPC RI 4 | 0.0009 | 0.02 | 0.00 |

Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Benzo(a)pyrene | East Fork | EFPC RI 4 | 0.0004 | 0.00 | 0.00 |
| BHC, total | East Fork | EFPC RI 4 | 0.0155 | 1.11 | 0.11 |
| Chlordane | East Fork | EFPC RI 4 | 0.0083 | 0.01 | 0.00 |
| Chromium | East Fork | EFPC RI 4 | 0.1188 | 0.05 | 0.01 |
| DDE | East Fork | EFPC RI 4 | 0.0029 | 0.01 | 0.00 |
| Dieldrin | East Fork | EFPC RI 4 | 0.0055 | 0.39 | 0.04 |
| Heptachlor, total | East Fork | EFPC RI 4 | 0.0114 | 0.11 | 0.01 |
| Lindane | East Fork | EFPC RI 4 | 0.0002 | 0.00 | |
| Mercury | East Fork | EFPC RI 4 | 0.0812 | 5.41 | 0.74 |
| Selenium | East Fork | EFPC RI 4 | 0.0656 | 2.73 | 0.27 |
| Uranium | East Fork | EFPC RI 4 | 0.0287 | 0.03 | 0.02 |
| Zinc | East Fork | EFPC RI 4 | 3.6917 | 0.03 | 0.02 |
| Aldrin | East Fork | EFPC RI 5 | 0.0028 | 0.02 | 0.00 |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 0.0006 | 0.00 | 0.00 |
| BHC, total | East Fork | EFPC RI 5 | 0.0156 | 1.11 | 0.11 |
| Chlordane | East Fork | EFPC RI 5 | 0.0088 | 0.01 | 0.00 |
| Chromium | East Fork | EFPC RI 5 | 0.1248 | 0.05 | 0.01 |
| DDE | East Fork | EFPC RI 5 | 0.0021 | 0.00 | 0.00 |
| Dieldrin | East Fork | EFPC RI 5 | 0.0067 | 0.48 | 0.05 |
| Heptachlor, total | East Fork | EFPC RI 5 | 0.0065 | 0.07 | 0.01 |
| Lindane | East Fork | EFPC RI 5 | 0.0003 | 0.00 | |
| Mercury | East Fork | EFPC RI 5 | 0.0594 | 3.96 | 0.54 |
| Selenium | East Fork | EFPC RI 5 | 0.0624 | 2.60 | 0.26 |
| Zinc | East Fork | EFPC RI 5 | 3.6847 | 0.03 | 0.02 |
| Mercury | East Fork | EFK6.3 | 0.0348 | 2.32 | 0.32 |
| Benzo(a)pyrene | East Fork | EFPC RI 6 | 0.0000 | 0.00 | 0.00 |
| Chlordane | East Fork | EFPC RI 6 | 0.0042 | 0.00 | 0.00 |

Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Chromium | East Fork | EFPC RI 6 | 0.0609 | 0.03 | 0.01 |
| Dieldrin | East Fork | EFPC RI 6 | 0.0032 | 0.23 | 0.02 |
| Heptachlor, total | East Fork | EFPC RI 6 | 0.0036 | 0.04 | 0.00 |
| Lindane | East Fork | EFPC RI 6 | 0.0003 | 0.00 | |
| Mercury | East Fork | EFPC RI 6 | 0.0345 | 2.30 | 0.31 |
| Selenium | East Fork | EFPC RI 6 | 0.0454 | 1.89 | 0.19 |
| Zinc | East Fork | EFPC RI 6 | 2.7056 | 0.02 | 0.01 |
| Mercury | East Fork | EFK2.1 | 0.0218 | 1.45 | 0.20 |
| Mercury | East Fork | EFK2 | 0.0288 | 1.92 | 0.26 |
| Mercury | K-25 | PCK18.2 | 0.0039 | 0.26 | 0.04 |
| Mercury | K-25 | PCK10.4 | 0.0087 | 0.58 | 0.08 |
| Mercury | K-25 | PCK8.2 | 0.0232 | 1.54 | 0.21 |
| Mercury | K-25 | MIK0.2 | 0.0137 | 0.92 | 0.12 |
| Mercury | K-25 | PCK6.9 | 0.0227 | 1.51 | 0.21 |
| Mercury | K-25 | PCK1.6 | 0.0127 | 0.85 | 0.12 |
| Mercury | K-25 | K-710 | 0.0068 | 0.45 | 0.06 |
| Mercury | K-25 | K-1007 | 0.0041 | 0.28 | 0.04 |
| Arsenic | K-25 | K-901 | 0.0344 | 0.86 | 0.09 |
| Chromium | K-25 | K-901 | 3.3362 | 1.44 | 0.36 |
| Copper | K-25 | K-901 | 0.1571 | 0.01 | 0.01 |
| Lead | K-25 | K-901 | 0.0389 | 0.01 | 0.00 |
| Mercury | K-25 | K-901 | 0.0037 | 0.25 | 0.03 |
| Nickel | K-25 | K-901 | 0.1197 | 0.00 | 0.00 |
| Selenium | K-25 | K-901 | 0.0449 | 1.87 | 0.19 |
| Zinc | K-25 | K-901 | 2.4311 | 0.02 | 0.01 |
| Mercury | White Oak | NTK0.2 | 0.0096 | 0.64 | 0.09 |
| Mercury | White Oak | WCK3.5 | 0.0136 | 0.91 | 0.12 |
| Mercury | White Oak | WCK2.9 | 0.0227 | 1.51 | 0.21 |

**Table C.8. Estimated exposure of mink on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Mercury | White Oak | MEK0.2 | 0.0068 | 0.45 | 0.06 |
| Mercury | White Oak | WCK2.3 | 0.0148 | 0.98 | 0.13 |
| Mercury | White Oak | WOL | 0.0087 | 0.58 | 0.08 |
| Mercury | White Oak | WCK0.9 | 0.0055 | 0.37 | 0.05 |
| Mercury | White Oak | WCK0.3 | 0.0095 | 0.64 | 0.09 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

**Table C.9. Estimated exposure of mink on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| Bear Creek | BCK12.4 | 0.0456 | 0.33 | 0.07 |
| Bear Creek | BCK9.4 | 0.3366 | 2.40 | 0.49 |
| Bear Creek | BCK4.5 | 0.3899 | 2.78 | 0.57 |
| Bear Creek | BCK3.3 | 0.1309 | 0.94 | 0.19 |
| Bear Creek | BCK0.6 | 0.0962 | 0.69 | 0.14 |
| East Fork | EFK24.8 | 1.7999 | 12.86 | 2.61 |
| East Fork | EFK24.4 | 0.6046 | 4.32 | 0.88 |
| East Fork | EFK24 | 0.3841 | 2.74 | 0.56 |
| East Fork | EFK23.7 | 0.5396 | 3.85 | 0.78 |
| East Fork | EFK23.5 | 0.6307 | 4.50 | 0.91 |
| East Fork | EFK23.4 | 0.3731 | 2.67 | 0.54 |
| East Fork | EFPC RI 1[a] | 0.6903 | 4.93 | 1.00 |
| East Fork | EFPC RI 2 | 0.8027 | 5.73 | 1.16 |
| East Fork | EFK18.4 | 0.2040 | 1.46 | 0.30 |
| East Fork | EFK18.2 | 0.1352 | 0.97 | 0.20 |
| East Fork | EFPC RI 3 | 0.2269 | 1.62 | 0.33 |
| East Fork | EFK13.8 | 0.1013 | 0.72 | 0.15 |
| East Fork | EFPC RI 4 | 0.1327 | 0.95 | 0.19 |
| East Fork | EFPC RI 5 | 0.0849 | 0.61 | 0.12 |
| East Fork | EFK6.3 | 0.0625 | 0.45 | 0.09 |
| East Fork | EFPC RI 6 | 0.0352 | 0.25 | 0.05 |
| East Fork | EFK2.1 | 0.0611 | 0.44 | 0.09 |
| K-25 | PCK18.2 | 0.0479 | 0.34 | 0.07 |
| K-25 | PCK10.4 | 0.0292 | 0.21 | 0.04 |
| K-25 | PCK8.2 | 0.0524 | 0.37 | 0.08 |
| K-25 | MIK0.2 | 0.4253 | 3.04 | 0.62 |
| K-25 | PCK6.9 | 0.0742 | 0.53 | 0.11 |

**Table C.9. Estimated exposure of mink on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| K-25 | PCK1.6 | 0.0711 | 0.51 | 0.10 |
| K-25 | K-1007 | 0.0262 | 0.19 | 0.04 |
| K-25 | K-901 | 1.1220 | 8.01 | 1.63 |
| White Oak | NTK0.2 | 0.1046 | 0.75 | 0.15 |
| White Oak | WCK3.5 | 0.2162 | 1.54 | 0.31 |
| White Oak | WCK2.9 | 0.1870 | 1.34 | 0.27 |
| White Oak | MEK0.2 | 0.0932 | 0.67 | 0.14 |
| White Oak | WCK2.3 | 0.1855 | 1.32 | 0.27 |
| White Oak | WOL | 0.2117 | 1.51 | 0.31 |
| White Oak | WCK0.9 | 0.1313 | 0.94 | 0.19 |
| White Oak | WCK0.3 | 0.1238 | 0.88 | 0.18 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK12.4 | 0.0016 | 0.08 | 0.01 |
| Arsenic | Bear Creek | BCK12.4 | 0.0555 | 2.77 | 0.28 |
| Beryllium | Bear Creek | BCK12.4 | 0.0057 | 0.02 | |
| Cadmium | Bear Creek | BCK12.4 | 0.3083 | 102.75 | 77.06 |
| Chromium | Bear Creek | BCK12.4 | 0.1316 | 0.11 | 0.03 |
| Copper | Bear Creek | BCK12.4 | 0.1294 | 0.02 | 0.02 |
| Lead | Bear Creek | BCK12.4 | 0.1238 | 0.04 | 0.00 |
| Lithium | Bear Creek | BCK12.4 | 0.0734 | 0.02 | 0.01 |
| Mercury | Bear Creek | BCK12.4 | 0.0191 | 2.39 | 0.32 |
| Nickel | Bear Creek | BCK12.4 | 0.5895 | 0.04 | 0.02 |
| Selenium | Bear Creek | BCK12.4 | 0.0605 | 5.04 | 0.50 |
| Thallium | Bear Creek | BCK12.4 | 0.0014 | 0.45 | 0.05 |
| Uranium | Bear Creek | BCK12.4 | 0.1373 | 0.29 | 0.14 |
| Zinc | Bear Creek | BCK12.4 | 4.9163 | 0.09 | 0.04 |
| Antimony | Bear Creek | BCK9.4 | 0.0015 | 0.07 | 0.01 |
| Arsenic | Bear Creek | BCK9.4 | 0.0645 | 3.22 | 0.32 |
| Beryllium | Bear Creek | BCK9.4 | 0.0037 | 0.02 | |
| Cadmium | Bear Creek | BCK9.4 | 0.0781 | 26.03 | 19.52 |
| Chromium | Bear Creek | BCK9.4 | 0.1418 | 0.12 | 0.03 |
| Copper | Bear Creek | BCK9.4 | 0.1463 | 0.02 | 0.02 |
| Lead | Bear Creek | BCK9.4 | 0.0945 | 0.03 | 0.00 |
| Lithium | Bear Creek | BCK9.4 | 0.1688 | 0.05 | 0.03 |
| Mercury | Bear Creek | BCK9.4 | 0.0124 | 1.55 | 0.21 |
| Nickel | Bear Creek | BCK9.4 | 0.1339 | 0.01 | 0.00 |
| Selenium | Bear Creek | BCK9.4 | 0.1260 | 10.50 | 1.05 |
| Thallium | Bear Creek | BCK9.4 | 0.0033 | 1.09 | 0.12 |
| Uranium | Bear Creek | BCK9.4 | 0.1575 | 0.33 | 0.16 |
| Zinc | Bear Creek | BCK9.4 | 6.6600 | 0.12 | 0.06 |
| Mercury | Bear Creek | BCK4.5 | 0.0425 | 5.31 | 0.71 |

Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK3.3 | 0.0008 | 0.04 | 0.00 |
| Arsenic | Bear Creek | BCK3.3 | 0.0451 | 2.26 | 0.23 |
| Beryllium | Bear Creek | BCK3.3 | 0.0027 | 0.01 | |
| Cadmium | Bear Creek | BCK3.3 | 0.0354 | 11.81 | 8.86 |
| Chromium | Bear Creek | BCK3.3 | 0.1260 | 0.11 | 0.03 |
| Copper | Bear Creek | BCK3.3 | 0.1283 | 0.02 | 0.02 |
| Lead | Bear Creek | BCK3.3 | 0.0585 | 0.02 | 0.00 |
| Lithium | Bear Creek | BCK3.3 | 0.0753 | 0.02 | 0.01 |
| Mercury | Bear Creek | BCK3.3 | 0.0097 | 1.21 | 0.16 |
| Nickel | Bear Creek | BCK3.3 | 0.1008 | 0.01 | 0.00 |
| Selenium | Bear Creek | BCK3.3 | 0.0884 | 7.37 | 0.74 |
| Thallium | Bear Creek | BCK3.3 | 0.0011 | 0.38 | 0.04 |
| Uranium | Bear Creek | BCK3.3 | 0.0627 | 0.13 | 0.06 |
| Zinc | Bear Creek | BCK3.3 | 9.1575 | 0.16 | 0.08 |
| Mercury | Bear Creek | BCK0.6 | 0.0378 | 4.73 | 0.63 |
| Mercury | East Fork | EFK24.8 | 0.1375 | 17.19 | 2.29 |
| Aldrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| BHC, total | East Fork | EFK24.4 | 0.0000 | 0.01 | 0.00 |
| Chlordane | East Fork | EFK24.4 | 0.0196 | 0.03 | 0.01 |
| DDT, total | East Fork | EFK24.4 | 0.0074 | 0.03 | 0.01 |
| Dieldrin | East Fork | EFK24.4 | 0.0035 | 0.49 | 0.05 |
| Endrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK24.4 | 0.3920 | 48.99 | 6.53 |
| Mercury | East Fork | EFK24 | 0.0506 | 6.33 | 0.84 |
| Mercury | East Fork | EFK23.7 | 0.0548 | 6.85 | 0.91 |
| Mercury | East Fork | EFK23.5 | 0.0540 | 6.75 | 0.90 |
| Aldrin | East Fork | EFK23.4 | 0.0001 | 0.00 | 0.00 |
| BHC, total | East Fork | EFK23.4 | 0.0001 | 0.01 | 0.00 |
| Chlordane | East Fork | EFK23.4 | 0.0166 | 0.02 | 0.01 |

**Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| DDT, total | East Fork | EFK23.4 | 0.0074 | 0.03 | 0.01 |
| Dieldrin | East Fork | EFK23.4 | 0.0046 | 0.65 | 0.07 |
| Endrin | East Fork | EFK23.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK23.4 | 0.0815 | 10.19 | 1.36 |
| Antimony | East Fork | EFPC RI 1[a] | 0.0086 | 0.43 | 0.04 |
| Arsenic | East Fork | EFPC RI 1 | 0.0360 | 1.80 | 0.18 |
| Benzo(a)pyrene | East Fork | EFPC RI 1 | 0.0031 | 0.02 | 0.00 |
| Chlordane | East Fork | EFPC RI 1 | 0.0296 | 0.04 | 0.02 |
| Chromium | East Fork | EFPC RI 1 | 0.3257 | 0.28 | 0.07 |
| DDE | East Fork | EFPC RI 1 | 0.0253 | 0.09 | 0.02 |
| Dieldrin | East Fork | EFPC RI 1 | 0.0119 | 1.71 | 0.17 |
| Heptachlor, total | East Fork | EFPC RI 1 | 0.0317 | 0.63 | 0.06 |
| Lindane | East Fork | EFPC RI 1 | 0.0007 | 0.00 | |
| Mercury | East Fork | EFPC RI 1 | 0.4093 | 51.16 | 6.82 |
| Selenium | East Fork | EFPC RI 1 | 0.0996 | 8.30 | 0.83 |
| Uranium | East Fork | EFPC RI 1 | 0.1021 | 0.21 | 0.10 |
| Zinc | East Fork | EFPC RI 1 | 10.1664 | 0.18 | 0.09 |
| Antimony | East Fork | EFPC RI 2 | 0.0013 | 0.06 | 0.01 |
| Arsenic | East Fork | EFPC RI 2 | 0.0430 | 2.15 | 0.21 |
| Benzo(a)pyrene | East Fork | EFPC RI 2 | 0.0028 | 0.02 | 0.00 |
| Chlordane | East Fork | EFPC RI 2 | 0.0402 | 0.06 | 0.03 |
| Chromium | East Fork | EFPC RI 2 | 0.5516 | 0.47 | 0.12 |
| DDE | East Fork | EFPC RI 2 | 0.0381 | 0.13 | 0.03 |
| Dieldrin | East Fork | EFPC RI 2 | 0.0143 | 2.04 | 0.20 |
| Heptachlor, total | East Fork | EFPC RI 2 | 0.0350 | 0.70 | 0.07 |
| Lindane | East Fork | EFPC RI 2 | 0.0007 | 0.00 | |
| Mercury | East Fork | EFPC RI 2 | 1.2095 | 151.19 | 20.16 |

Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Selenium | East Fork | EFPC RI 2 | 0.1160 | 9.66 | 0.97 |
| Uranium | East Fork | EFPC RI 2 | 0.0950 | 0.20 | 0.09 |
| Zinc | East Fork | EFPC RI 2 | 10.4904 | 0.18 | 0.09 |
| Aldrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| BHC, total | East Fork | EFK18.4 | 0.0001 | 0.01 | 0.00 |
| Chlordane | East Fork | EFK18.4 | 0.0493 | 0.07 | 0.03 |
| DDT, total | East Fork | EFK18.4 | 0.0132 | 0.05 | 0.01 |
| Dieldrin | East Fork | EFK18.4 | 0.0067 | 0.95 | 0.10 |
| Endrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK18.2 | 0.0709 | 8.86 | 1.18 |
| Mercury | East Fork | EFK18 | 0.0600 | 7.49 | 1.00 |
| Antimony | East Fork | EFPC RI 3 | 0.0012 | 0.06 | 0.01 |
| Arsenic | East Fork | EFPC RI 3 | 0.0324 | 1.62 | 0.16 |
| Benzo(a)pyrene | East Fork | EFPC RI 3 | 0.0016 | 0.01 | 0.00 |
| Chlordane | East Fork | EFPC RI 3 | 0.0127 | 0.02 | 0.01 |
| Chromium | East Fork | EFPC RI 3 | 0.2759 | 0.24 | 0.06 |
| DDE | East Fork | EFPC RI 3 | 0.0071 | 0.02 | 0.01 |
| Dieldrin | East Fork | EFPC RI 3 | 0.0059 | 0.85 | 0.08 |
| Heptachlor, total | East Fork | EFPC RI 3 | 0.0172 | 0.34 | 0.03 |
| Lindane | East Fork | EFPC RI 3 | 0.0005 | 0.00 | |
| Mercury | East Fork | EFPC RI 3 | 0.2737 | 34.22 | 4.56 |
| Selenium | East Fork | EFPC RI 3 | 0.0824 | 6.87 | 0.69 |
| Uranium | East Fork | EFPC RI 3 | 0.0633 | 0.13 | 0.06 |
| Zinc | East Fork | EFPC RI 3 | 6.9112 | 0.12 | 0.06 |
| Mercury | East Fork | EFK13.8 | 0.0650 | 8.13 | 1.08 |
| Aldrin | East Fork | EFPC RI 4 | 0.0037 | 0.05 | 0.01 |
| Antimony | East Fork | EFPC RI 4 | 0.0014 | 0.07 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 4 | 0.0006 | 0.00 | 0.00 |

**Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| BHC, total | East Fork | EFPC RI 4 | 0.0233 | 3.33 | 0.33 |
| Chlordane | East Fork | EFPC RI 4 | 0.0125 | 0.02 | 0.01 |
| Chromium | East Fork | EFPC RI 4 | 0.1787 | 0.15 | 0.04 |
| DDE | East Fork | EFPC RI 4 | 0.0044 | 0.02 | 0.00 |
| Dieldrin | East Fork | EFPC RI 4 | 0.0083 | 1.18 | 0.12 |
| Heptachlor, total | East Fork | EFPC RI 4 | 0.0171 | 0.34 | 0.03 |
| Lindane | East Fork | EFPC RI 4 | 0.0002 | 0.00 | |
| Mercury | East Fork | EFPC RI 4 | 0.1221 | 15.26 | 2.04 |
| Selenium | East Fork | EFPC RI 4 | 0.0986 | 8.22 | 0.82 |
| Uranium | East Fork | EFPC RI 4 | 0.0432 | 0.09 | 0.04 |
| Zinc | East Fork | EFPC RI 4 | 5.5523 | 0.10 | 0.05 |
| Aldrin | East Fork | EFPC RI 5 | 0.0042 | 0.06 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 0.0009 | 0.01 | 0.00 |
| BHC, total | East Fork | EFPC RI 5 | 0.0234 | 3.35 | 0.33 |
| Chlordane | East Fork | EFPC RI 5 | 0.0133 | 0.02 | 0.01 |
| Chromium | East Fork | EFPC RI 5 | 0.1877 | 0.16 | 0.04 |
| DDE | East Fork | EFPC RI 5 | 0.0032 | 0.01 | 0.00 |
| Dieldrin | East Fork | EFPC RI 5 | 0.0101 | 1.44 | 0.14 |
| Heptachlor, total | East Fork | EFPC RI 5 | 0.0098 | 0.20 | 0.02 |
| Lindane | East Fork | EFPC RI 5 | 0.0005 | 0.00 | |
| Mercury | East Fork | EFPC RI 5 | 0.0893 | 11.16 | 1.49 |
| Selenium | East Fork | EFPC RI 5 | 0.0938 | 7.82 | 0.78 |
| Zinc | East Fork | EFPC RI 5 | 5.5416 | 0.10 | 0.05 |
| Mercury | East Fork | EFK6.3 | 0.0524 | 6.55 | 0.87 |
| Benzo(a)pyrene | East Fork | EFPC RI 6 | 0.0001 | 0.00 | 0.00 |
| Chlordane | East Fork | EFPC RI 6 | 0.0063 | 0.01 | 0.00 |
| Chromium | East Fork | EFPC RI 6 | 0.0915 | 0.08 | 0.02 |

**Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Dieldrin | East Fork | EFPC RI 6 | 0.0048 | 0.69 | 0.07 |
| Heptachlor, total | East Fork | EFPC RI 6 | 0.0054 | 0.11 | 0.01 |
| Lindane | East Fork | EFPC RI 6 | 0.0004 | 0.00 | |
| Mercury | East Fork | EFPC RI 6 | 0.0520 | 6.49 | 0.87 |
| Selenium | East Fork | EFPC RI 6 | 0.0682 | 5.68 | 0.57 |
| Zinc | East Fork | EFPC RI 6 | 4.0691 | 0.07 | 0.04 |
| Mercury | East Fork | EFK2.1 | 0.0327 | 4.09 | 0.55 |
| Mercury | East Fork | EFK2 | 0.0434 | 5.42 | 0.72 |
| Mercury | K-25 | PCK18.2 | 0.0058 | 0.73 | 0.10 |
| Mercury | K-25 | PCK10.4 | 0.0131 | 1.64 | 0.22 |
| Mercury | K-25 | PCK8.2 | 0.0348 | 4.35 | 0.58 |
| Mercury | K-25 | MIK0.2 | 0.0207 | 2.58 | 0.34 |
| Mercury | K-25 | PCK6.9 | 0.0341 | 4.26 | 0.57 |
| Mercury | K-25 | PCK1.6 | 0.0191 | 2.39 | 0.32 |
| Mercury | K-25 | K-1007 | 0.0062 | 0.78 | 0.10 |
| Mercury | K-25 | K-710 | 0.0102 | 1.28 | 0.17 |
| Arsenic | K-25 | K-901 | 0.0518 | 2.59 | 0.26 |
| Cadmium | K-25 | K-901 | 0.0283 | 9.43 | 7.07 |
| Chromium | K-25 | K-901 | 2.5243 | 2.14 | 0.53 |
| Copper | K-25 | K-901 | 0.2864 | 0.02 | 0.02 |
| Lead | K-25 | K-901 | 0.1069 | 0.01 | 0.00 |
| Mercury | K-25 | K-901 | 0.0449 | 0.35 | 0.05 |
| Nickel | K-25 | K-901 | 0.1800 | 0.01 | 0.01 |
| Selenium | K-25 | K-901 | 0.0885 | 2.81 | 0.28 |
| Zinc | K-25 | K-901 | 3.7931 | 0.03 | 0.02 |
| Mercury | White Oak | NTK0.2 | 0.0144 | 1.80 | 0.24 |
| Mercury | White Oak | WCK3.5 | 0.0205 | 2.57 | 0.34 |
| Mercury | White Oak | WCK2.9 | 0.0341 | 4.26 | 0.57 |

**Table C.10. Estimated exposure of river otter on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Mercury | White Oak | MEK0.2 | 0.0102 | 1.28 | 0.17 |
| Mercury | White Oak | WCK2.3 | 0.0222 | 2.77 | 0.37 |
| Mercury | White Oak | WOL | 0.0131 | 1.64 | 0.22 |
| Mercury | White Oak | WCK0.9 | 0.0083 | 1.04 | 0.14 |
| Mercury | White Oak | WCK0.3 | 0.0143 | 1.79 | 0.24 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

**Table C.11. Estimated exposure of river otter on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| Bear Creek | BCK12.4 | 0.0686 | 0.98 | 0.20 |
| Bear Creek | BCK9.4 | 0.5063 | 7.23 | 1.45 |
| Bear Creek | BCK4.5 | 0.5864 | 8.38 | 1.68 |
| Bear Creek | BCK3.3 | 0.1969 | 2.81 | 0.56 |
| Bear Creek | BCK0.6 | 0.1447 | 2.07 | 0.41 |
| East Fork | EFK24.8 | 2.7071 | 38.67 | 7.73 |
| East Fork | EFK24.4 | 0.9092 | 12.99 | 2.60 |
| East Fork | EFK24 | 0.5777 | 8.25 | 1.65 |
| East Fork | EFK23.7 | 0.8116 | 11.59 | 2.32 |
| East Fork | EFK23.5 | 0.9485 | 13.55 | 2.71 |
| East Fork | EFK23.4 | 0.4330 | 6.19 | 1.24 |
| East Fork | EFPC RI 1[a] | 1.0382 | 14.83 | 2.97 |
| East Fork | EFPC RI 2 | 1.2072 | 17.25 | 3.45 |
| East Fork | EFK18.4 | 0.3068 | 4.38 | 0.88 |
| East Fork | EFK18.2 | 0.5156 | 7.37 | 1.47 |
| East Fork | EFPC RI 3 | 0.7773 | 11.10 | 2.22 |
| East Fork | EFK13.8 | 0.4664 | 6.66 | 1.33 |
| East Fork | EFPC RI 4 | 0.1996 | 2.85 | 0.57 |
| East Fork | EFK10 | 0.4095 | 5.85 | 1.17 |
| East Fork | EFPC RI 5 | 0.1161 | 1.66 | 0.33 |
| East Fork | EFK6.3 | 0.2894 | 4.13 | 0.83 |
| East Fork | EFPC RI 6 | 0.0529 | 0.76 | 0.15 |
| East Fork | EFK2.1 | 0.3287 | 4.70 | 0.94 |
| K-25 | PCK18.2 | 0.0479 | 0.68 | 0.14 |
| K-25 | PCK10.4 | 0.0292 | 0.42 | 0.08 |
| K-25 | PCK8.2 | 0.0524 | 0.75 | 0.15 |
| K-25 | MIK0.2 | 0.4253 | 6.08 | 1.22 |

**Table C.11. Estimated exposure of river otter on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| K-25 | PCK6.9 | 0.0742 | 1.06 | 0.21 |
| K-25 | PCK1.6 | 0.0711 | 1.02 | 0.20 |
| K-25 | K-1007 | 5.2446 | 74.92 | 14.98 |
| K-25 | K-710 | 0.3988 | 5.70 | 1.14 |
| K-25 | K-901 | 1.2430 | 12.05 | 2.41 |
| White Oak | NTK0.2 | 0.1046 | 1.49 | 0.30 |
| White Oak | WCK3.5 | 0.3143 | 4.49 | 0.90 |
| White Oak | WCK2.9 | 0.1870 | 2.67 | 0.53 |
| White Oak | MEK0.2 | 0.0932 | 1.33 | 0.27 |
| White Oak | WCK2.3 | 0.1855 | 2.65 | 0.53 |
| White Oak | WOL | 0.9212 | 13.16 | 2.63 |
| White Oak | WCK0.9 | 0.1313 | 1.88 | 0.38 |
| White Oak | WCK0.3 | 0.1238 | 1.77 | 0.35 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK12.4 | 0.0071 | | |
| Arsenic | Bear Creek | BCK12.4 | 0.2498 | 0.03 | 0.01 |
| Beryllium | Bear Creek | BCK12.4 | 0.0258 | | |
| Cadmium | Bear Creek | BCK12.4 | 1.3885 | 0.48 | 0.04 |
| Chromium | Bear Creek | BCK12.4 | 0.5929 | 0.30 | 0.06 |
| Copper | Bear Creek | BCK12.4 | 0.5828 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK12.4 | 0.5574 | 0.15 | 0.05 |
| Lithium | Bear Creek | BCK12.4 | 0.3304 | | |
| Mercury | Bear Creek | BCK12.4 | 0.0861 | 7.18 | 0.72 |
| Nickel | Bear Creek | BCK12.4 | 2.6554 | 0.02 | 0.01 |
| Selenium | Bear Creek | BCK12.4 | 0.2726 | 0.30 | 0.14 |
| Thallium | Bear Creek | BCK12.4 | 0.0061 | | |
| Uranium | Bear Creek | BCK12.4 | 0.6182 | 0.02 | |
| Zinc | Bear Creek | BCK12.4 | 22.1453 | 0.65 | 0.07 |
| Antimony | Bear Creek | BCK9.4 | 0.0066 | | |
| Arsenic | Bear Creek | BCK9.4 | 0.2904 | 0.03 | 0.01 |
| Beryllium | Bear Creek | BCK9.4 | 0.0167 | | |
| Cadmium | Bear Creek | BCK9.4 | 0.3517 | 0.12 | 0.01 |
| Chromium | Bear Creek | BCK9.4 | 0.6385 | 0.32 | 0.06 |
| Copper | Bear Creek | BCK9.4 | 0.6588 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK9.4 | 0.4257 | 0.12 | 0.04 |
| Lithium | Bear Creek | BCK9.4 | 0.7601 | | |
| Mercury | Bear Creek | BCK9.4 | 0.0557 | 4.65 | 0.46 |
| Nickel | Bear Creek | BCK9.4 | 0.6030 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK9.4 | 0.5676 | 0.63 | 0.30 |
| Thallium | Bear Creek | BCK9.4 | 0.0147 | | |
| Uranium | Bear Creek | BCK9.4 | 0.7095 | 0.02 | |
| Zinc | Bear Creek | BCK9.4 | 30.0000 | 0.88 | 0.10 |
| Mercury | Bear Creek | BCK4.5 | 0.1915 | 15.96 | 1.60 |

**Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK3.3 | 0.0035 | | |
| Arsenic | Bear Creek | BCK3.3 | 0.2032 | 0.02 | 0.01 |
| Beryllium | Bear Creek | BCK3.3 | 0.0122 | | |
| Cadmium | Bear Creek | BCK3.3 | 0.1596 | 0.06 | 0.00 |
| Chromium | Bear Creek | BCK3.3 | 0.5676 | 0.28 | 0.06 |
| Copper | Bear Creek | BCK3.3 | 0.5777 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK3.3 | 0.2635 | 0.07 | 0.02 |
| Lithium | Bear Creek | BCK3.3 | 0.3390 | | |
| Mercury | Bear Creek | BCK3.3 | 0.0436 | 3.63 | 0.36 |
| Nickel | Bear Creek | BCK3.3 | 0.4541 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK3.3 | 0.3983 | 0.44 | 0.21 |
| Thallium | Bear Creek | BCK3.3 | 0.0051 | | |
| Uranium | Bear Creek | BCK3.3 | 0.2823 | 0.01 | |
| Zinc | Bear Creek | BCK3.3 | 41.2500 | 1.22 | 0.13 |
| Mercury | Bear Creek | BCK0.6 | 0.1703 | 14.19 | 1.42 |
| Mercury | East Fork | EFK24.8 | 0.6196 | 51.63 | 5.16 |
| Aldrin | East Fork | EFK24.4 | 0.0000 | 0.00 | |
| BHC, total | East Fork | EFK24.4 | 0.0002 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK24.4 | 0.0882 | 0.05 | 0.01 |
| DDT, total | East Fork | EFK24.4 | 0.0335 | 4.18 | 0.42 |
| Dieldrin | East Fork | EFK24.4 | 0.0156 | 0.14 | |
| Endrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK24.4 | 1.7656 | 147.13 | 14.71 |
| Mercury | East Fork | EFK24 | 0.2281 | 19.01 | 1.90 |
| Mercury | East Fork | EFK23.7 | 0.2469 | 20.57 | 2.06 |
| Mercury | East Fork | EFK23.5 | 0.2432 | 20.27 | 2.03 |
| Aldrin | East Fork | EFK23.4 | 0.0005 | 0.00 | |
| BHC, total | East Fork | EFK23.4 | 0.0004 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK23.4 | 0.0749 | 0.05 | 0.01 |

Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| DDT, total | East Fork | EFK23.4 | 0.0333 | 4.16 | 0.42 |
| Dieldrin | East Fork | EFK23.4 | 0.0205 | 0.18 | |
| Endrin | East Fork | EFK23.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK23.4 | 0.6391 | 53.26 | 5.33 |
| Antimony | East Fork | EFPC RI 1[a] | 0.0385 | | |
| Arsenic | East Fork | EFPC RI 1 | 0.1624 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 1 | 0.0140 | | |
| Chlordane | East Fork | EFPC RI 1 | 0.1334 | 0.08 | 0.02 |
| Chromium | East Fork | EFPC RI 1 | 1.4671 | 0.73 | 0.15 |
| DDE | East Fork | EFPC RI 1 | 0.1138 | 14.22 | 1.42 |
| Dieldrin | East Fork | EFPC RI 1 | 0.0538 | 0.48 | |
| Heptachlor, total | East Fork | EFPC RI 1 | 0.1428 | | |
| Lindane | East Fork | EFPC RI 1 | 0.0033 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 1 | 1.8437 | 153.64 | 15.36 |
| Selenium | East Fork | EFPC RI 1 | 0.4486 | 0.50 | 0.24 |
| Uranium | East Fork | EFPC RI 1 | 0.4599 | 0.01 | |
| Zinc | East Fork | EFPC RI 1 | 45.7947 | 1.35 | 0.15 |
| Antimony | East Fork | EFPC RI 2 | 0.0058 | | |
| Arsenic | East Fork | EFPC RI 2 | 0.1935 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 2 | 0.0127 | | |
| Chlordane | East Fork | EFPC RI 2 | 0.1809 | 0.11 | 0.02 |
| Chromium | East Fork | EFPC RI 2 | 2.4847 | 1.24 | 0.25 |
| DDE | East Fork | EFPC RI 2 | 0.1715 | 21.44 | 2.14 |
| Dieldrin | East Fork | EFPC RI 2 | 0.0642 | 0.57 | |
| Heptachlor, total | East Fork | EFPC RI 2 | 0.1578 | | |
| Lindane | East Fork | EFPC RI 2 | 0.0030 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 2 | 5.4484 | 454.03 | 45.40 |

**Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Selenium | East Fork | EFPC RI 2 | 0.5223 | 0.58 | 0.27 |
| Uranium | East Fork | EFPC RI 2 | 0.4279 | 0.01 | |
| Zinc | East Fork | EFPC RI 2 | 47.2543 | 1.39 | 0.15 |
| Aldrin | East Fork | EFK18.4 | 0.0000 | 0.00 | |
| BHC, total | East Fork | EFK18.4 | 0.0003 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK18.4 | 0.2223 | 0.14 | 0.03 |
| DDT, total | East Fork | EFK18.4 | 0.0597 | 7.46 | 0.75 |
| Dieldrin | East Fork | EFK18.4 | 0.0300 | 0.27 | |
| Endrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK18.2 | 0.3192 | 26.60 | 2.66 |
| Mercury | East Fork | EFK18 | 0.2701 | 22.50 | 2.25 |
| Antimony | East Fork | EFPC RI 3 | 0.0055 | | |
| Arsenic | East Fork | EFPC RI 3 | 0.1461 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 3 | 0.0074 | | |
| Chlordane | East Fork | EFPC RI 3 | 0.0573 | 0.04 | 0.01 |
| Chromium | East Fork | EFPC RI 3 | 1.2428 | 0.62 | 0.12 |
| DDE | East Fork | EFPC RI 3 | 0.0321 | 4.01 | 0.40 |
| Dieldrin | East Fork | EFPC RI 3 | 0.0267 | 0.24 | |
| Heptachlor, total | East Fork | EFPC RI 3 | 0.0773 | | |
| Lindane | East Fork | EFPC RI 3 | 0.0022 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 3 | 1.2330 | 102.75 | 10.27 |
| Selenium | East Fork | EFPC RI 3 | 0.3713 | 0.41 | 0.20 |
| Uranium | East Fork | EFPC RI 3 | 0.2851 | 0.01 | |
| Zinc | East Fork | EFPC RI 3 | 31.1314 | 0.92 | 0.10 |
| Mercury | East Fork | EFK13.8 | 0.2929 | 24.41 | 2.44 |
| Aldrin | East Fork | EFPC RI 4 | 0.0167 | 0.15 | |
| Antimony | East Fork | EFPC RI 4 | 0.0062 | | |
| Benzo(a)pyrene | East Fork | EFPC RI 4 | 0.0029 | | |

**Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| BHC, total | East Fork | EFPC RI 4 | 0.1052 | 0.19 | 0.05 |
| Chlordane | East Fork | EFPC RI 4 | 0.0563 | 0.03 | 0.01 |
| Chromium | East Fork | EFPC RI 4 | 0.8051 | 0.40 | 0.08 |
| DDE | East Fork | EFPC RI 4 | 0.0197 | 2.46 | 0.25 |
| Dieldrin | East Fork | EFPC RI 4 | 0.0373 | 0.33 | |
| Heptachlor, total | East Fork | EFPC RI 4 | 0.0772 | | |
| Lindane | East Fork | EFPC RI 4 | 0.0011 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 4 | 0.5500 | 45.84 | 4.58 |
| Selenium | East Fork | EFPC RI 4 | 0.4443 | 0.49 | 0.23 |
| Uranium | East Fork | EFPC RI 4 | 0.1947 | 0.01 | |
| Zinc | East Fork | EFPC RI 4 | 25.0102 | 0.74 | 0.08 |
| Aldrin | East Fork | EFPC RI 5 | 0.0188 | 0.17 | |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 0.0040 | | |
| BHC, total | East Fork | EFPC RI 5 | 0.1056 | 0.19 | 0.05 |
| Chlordane | East Fork | EFPC RI 5 | 0.0599 | 0.04 | 0.01 |
| Chromium | East Fork | EFPC RI 5 | 0.8457 | 0.42 | 0.08 |
| DDE | East Fork | EFPC RI 5 | 0.0142 | 1.77 | 0.18 |
| Dieldrin | East Fork | EFPC RI 5 | 0.0453 | 0.40 | |
| Heptachlor, total | East Fork | EFPC RI 5 | 0.0441 | | |
| Lindane | East Fork | EFPC RI 5 | 0.0021 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 5 | 0.4023 | 33.53 | 3.35 |
| Selenium | East Fork | EFPC RI 5 | 0.4226 | 0.47 | 0.22 |
| Zinc | East Fork | EFPC RI 5 | 24.9623 | 0.74 | 0.08 |
| Mercury | East Fork | EFK6.3 | 0.2359 | 19.66 | 1.97 |
| Benzo(a)pyrene | East Fork | EFPC RI 6 | 0.0003 | | |
| Chlordane | East Fork | EFPC RI 6 | 0.0284 | 0.02 | 0.00 |
| Chromium | East Fork | EFPC RI 6 | 0.4122 | 0.21 | 0.04 |

**Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Dieldrin | East Fork | EFPC RI 6 | 0.0218 | 0.19 | |
| Heptachlor, total | East Fork | EFPC RI 6 | 0.0243 | | |
| Lindane | East Fork | EFPC RI 6 | 0.0019 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 6 | 0.2340 | 19.50 | 1.95 |
| Selenium | East Fork | EFPC RI 6 | 0.3072 | 0.34 | 0.16 |
| Zinc | East Fork | EFPC RI 6 | 18.3291 | 0.54 | 0.06 |
| Mercury | East Fork | EFK2.1 | 0.1474 | 12.28 | 1.23 |
| Mercury | East Fork | EFK2 | 0.1953 | 16.28 | 1.63 |
| Mercury | K-25 | PCK18.2 | 0.0263 | 2.20 | 0.22 |
| Mercury | K-25 | PCK10.4 | 0.0592 | 4.93 | 0.49 |
| Mercury | K-25 | PCK8.2 | 0.1569 | 13.07 | 1.31 |
| Mercury | K-25 | MIK0.2 | 0.0931 | 7.76 | 0.78 |
| Mercury | K-25 | PCK6.9 | 0.1537 | 12.81 | 1.28 |
| Mercury | K-25 | PCK1.6 | 0.0861 | 7.17 | 0.72 |
| Mercury | K-25 | K-710 | 0.0461 | 3.84 | 0.38 |
| Mercury | K-25 | K-1007 | 0.0280 | 2.33 | 0.23 |
| Arsenic | K-25 | K-901 | 0.2331 | 0.02 | 0.01 |
| Chromium | K-25 | K-901 | 22.6014 | 11.30 | 2.24 |
| Copper | K-25 | K-901 | 1.0642 | 0.01 | 0.01 |
| Lead | K-25 | K-901 | 0.2635 | 0.07 | 0.02 |
| Mercury | K-25 | K-901 | 0.0253 | 2.11 | 0.21 |
| Nickel | K-25 | K-901 | 0.8108 | 0.01 | 0.00 |
| Selenium | K-25 | K-901 | 0.3041 | 0.34 | 0.16 |
| Zinc | K-25 | K-901 | 16.4696 | 0.49 | 0.05 |
| Mercury | White Oak | NTK0.2 | 0.0648 | 5.40 | 0.54 |
| Mercury | White Oak | WCK3.5 | 0.0924 | 7.70 | 0.77 |
| Mercury | White Oak | WCK2.9 | 0.1536 | 12.80 | 1.28 |
| Mercury | White Oak | MEK0.2 | 0.0461 | 3.84 | 0.38 |

**Table C.12. Estimated exposure of belted kingfisher on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Mercury | White Oak | WCK2.3 | 0.1000 | 8.33 | 0.83 |
| Mercury | White Oak | WOL | 0.0590 | 4.91 | 0.49 |
| Mercury | White Oak | WCK0.9 | 0.0376 | 3.13 | 0.31 |
| Mercury | White Oak | WCK0.3 | 0.0646 | 5.38 | 0.54 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

Table C.13. Estimated exposure of belted kingfisher on the ORR to PCBs

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| Bear Creek | BCK12.4 | 0.3091 | 0.91 | 0.09 |
| Bear Creek | BCK9.4 | 2.2804 | 6.71 | 0.67 |
| Bear Creek | BCK4.5 | 2.6414 | 7.77 | 0.78 |
| Bear Creek | BCK3.3 | 0.8868 | 2.61 | 0.26 |
| Bear Creek | BCK0.6 | 0.6516 | 1.92 | 0.19 |
| East Fork | EFK24.8 | 12.1940 | 35.86 | 3.59 |
| East Fork | EFK24.4 | 4.0957 | 12.05 | 1.20 |
| East Fork | EFK24 | 2.6022 | 7.65 | 0.77 |
| East Fork | EFK23.7 | 3.6558 | 10.75 | 1.08 |
| East Fork | EFK23.5 | 4.2727 | 12.57 | 1.26 |
| East Fork | EFK23.4 | 2.5276 | 7.43 | 0.74 |
| East Fork | EFPC RI 1[a] | 4.6766 | 13.75 | 1.38 |
| East Fork | EFPC RI 2 | 5.4380 | 15.99 | 1.60 |
| East Fork | EFK18.4 | 1.3818 | 4.06 | 0.41 |
| East Fork | EFK18.2 | 0.9161 | 2.69 | 0.27 |
| East Fork | EFPC RI 3 | 1.5368 | 4.52 | 0.45 |
| East Fork | EFK13.8 | 0.6865 | 2.02 | 0.20 |
| East Fork | EFPC RI 4 | 0.8990 | 2.64 | 0.26 |
| East Fork | EFPC RI 5 | 0.5752 | 1.69 | 0.17 |
| East Fork | EFK6.3 | 0.4235 | 1.25 | 0.12 |
| East Fork | EFPC RI 6 | 0.2382 | 0.70 | 0.07 |
| East Fork | EFK2.1 | 0.4141 | 1.22 | 0.12 |
| K-25 | PCK18.2 | 0.3244 | 0.95 | 0.10 |
| K-25 | PCK10.4 | 0.1981 | 0.58 | 0.06 |
| K-25 | PCK8.2 | 0.3552 | 1.04 | 0.10 |
| K-25 | MIK0.2 | 2.8815 | 8.47 | 0.85 |
| K-25 | PCK6.9 | 0.5026 | 1.48 | 0.15 |

**Table C.13. Estimated exposure of belted kingfisher on the ORR to PCB**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| K-25 | PCK1.6 | 0.4820 | 1.42 | 0.14 |
| K-25 | K-1007 | 0.1774 | 0.52 | 0.05 |
| K-25 | K-901 | 7.6014 | 22.36 | 2.24 |
| White Oak | NTK0.2 | 0.7089 | 2.09 | 0.21 |
| White Oak | WCK3.5 | 1.4645 | 4.31 | 0.43 |
| White Oak | WCK2.9 | 1.2667 | 3.73 | 0.37 |
| White Oak | MEK0.2 | 0.6316 | 1.86 | 0.19 |
| White Oak | WCK2.3 | 1.2565 | 3.70 | 0.37 |
| White Oak | WOL | 1.4340 | 4.22 | 0.42 |
| White Oak | WCK0.9 | 0.8895 | 2.62 | 0.26 |
| White Oak | WCK0.3 | 0.8385 | 2.47 | 0.25 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK12.4 | 0.0071 | | |
| Arsenic | Bear Creek | BCK12.4 | 0.2498 | 0.03 | 0.01 |
| Beryllium | Bear Creek | BCK12.4 | 0.0258 | | |
| Cadmium | Bear Creek | BCK12.4 | 1.3885 | 0.48 | 0.04 |
| Chromium | Bear Creek | BCK12.4 | 0.5929 | 0.30 | 0.06 |
| Copper | Bear Creek | BCK12.4 | 0.5828 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK12.4 | 0.5574 | 0.15 | 0.05 |
| Lithium | Bear Creek | BCK12.4 | 0.3304 | | |
| Mercury | Bear Creek | BCK12.4 | 0.0861 | 7.18 | 0.72 |
| Nickel | Bear Creek | BCK12.4 | 2.6554 | 0.02 | 0.01 |
| Selenium | Bear Creek | BCK12.4 | 0.2726 | 0.30 | 0.14 |
| Thallium | Bear Creek | BCK12.4 | 0.0061 | | |
| Uranium | Bear Creek | BCK12.4 | 0.6182 | 0.02 | |
| Zinc | Bear Creek | BCK12.4 | 22.1453 | 0.65 | 0.07 |
| Antimony | Bear Creek | BCK9.4 | 0.0066 | | |
| Arsenic | Bear Creek | BCK9.4 | 0.2904 | 0.03 | 0.01 |
| Beryllium | Bear Creek | BCK9.4 | 0.0167 | | |
| Cadmium | Bear Creek | BCK9.4 | 0.3517 | 0.12 | 0.01 |
| Chromium | Bear Creek | BCK9.4 | 0.6385 | 0.32 | 0.06 |
| Copper | Bear Creek | BCK9.4 | 0.6588 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK9.4 | 0.4257 | 0.12 | 0.04 |
| Lithium | Bear Creek | BCK9.4 | 0.7601 | | |
| Mercury | Bear Creek | BCK9.4 | 0.0557 | 4.65 | 0.46 |
| Nickel | Bear Creek | BCK9.4 | 0.6030 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK9.4 | 0.5676 | 0.63 | 0.30 |
| Thallium | Bear Creek | BCK9.4 | 0.0147 | | |
| Uranium | Bear Creek | BCK9.4 | 0.7095 | 0.02 | |
| Zinc | Bear Creek | BCK9.4 | 30.0000 | 0.88 | 0.10 |
| Mercury | Bear Creek | BCK4.5 | 0.1915 | 15.96 | 1.60 |

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Antimony | Bear Creek | BCK3.3 | 0.0035 | | |
| Arsenic | Bear Creek | BCK3.3 | 0.2032 | 0.02 | 0.01 |
| Beryllium | Bear Creek | BCK3.3 | 0.0122 | | |
| Cadmium | Bear Creek | BCK3.3 | 0.1596 | 0.06 | 0.00 |
| Chromium | Bear Creek | BCK3.3 | 0.5676 | 0.28 | 0.06 |
| Copper | Bear Creek | BCK3.3 | 0.5777 | 0.01 | 0.01 |
| Lead | Bear Creek | BCK3.3 | 0.2635 | 0.07 | 0.02 |
| Lithium | Bear Creek | BCK3.3 | 0.3390 | | |
| Mercury | Bear Creek | BCK3.3 | 0.0436 | 3.63 | 0.36 |
| Nickel | Bear Creek | BCK3.3 | 0.4541 | 0.00 | 0.00 |
| Selenium | Bear Creek | BCK3.3 | 0.3983 | 0.44 | 0.21 |
| Thallium | Bear Creek | BCK3.3 | 0.0051 | | |
| Uranium | Bear Creek | BCK3.3 | 0.2823 | 0.01 | |
| Zinc | Bear Creek | BCK3.3 | 41.2500 | 1.22 | 0.13 |
| Mercury | Bear Creek | BCK0.6 | 0.1703 | 14.19 | 1.42 |
| Mercury | East Fork | EFK24.8 | 0.6196 | 51.63 | 5.16 |
| Aldrin | East Fork | EFK24.4 | 0.0000 | 0.00 | |
| BHC, total | East Fork | EFK24.4 | 0.0002 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK24.4 | 0.0882 | 0.05 | 0.01 |
| DDT, total | East Fork | EFK24.4 | 0.0335 | 4.18 | 0.42 |
| Dieldrin | East Fork | EFK24.4 | 0.0156 | 0.14 | |
| Endrin | East Fork | EFK24.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK24.4 | 1.7656 | 147.13 | 14.71 |
| Mercury | East Fork | EFK24 | 0.2281 | 19.01 | 1.90 |
| Mercury | East Fork | EFK23.7 | 0.2469 | 20.57 | 2.06 |
| Mercury | East Fork | EFK23.5 | 0.2432 | 20.27 | 2.03 |
| Aldrin | East Fork | EFK23.4 | 0.0005 | 0.00 | |
| BHC, total | East Fork | EFK23.4 | 0.0004 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK23.4 | 0.0749 | 0.05 | 0.01 |

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| DDT, total | East Fork | EFK23.4 | 0.0333 | 4.16 | 0.42 |
| Dieldrin | East Fork | EFK23.4 | 0.0205 | 0.18 | |
| Endrin | East Fork | EFK23.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK23.4 | 0.6391 | 53.26 | 5.33 |
| Antimony | East Fork | EFPC RI 1[a] | 0.0385 | | |
| Arsenic | East Fork | EFPC RI 1 | 0.1624 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 1 | 0.0140 | | |
| Chlordane | East Fork | EFPC RI 1 | 0.1334 | 0.08 | 0.02 |
| Chromium | East Fork | EFPC RI 1 | 1.4671 | 0.73 | 0.15 |
| DDE | East Fork | EFPC RI 1 | 0.1138 | 14.22 | 1.42 |
| Dieldrin | East Fork | EFPC RI 1 | 0.0538 | 0.48 | |
| Heptachlor, total | East Fork | EFPC RI 1 | 0.1428 | | |
| Lindane | East Fork | EFPC RI 1 | 0.0033 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 1 | 1.8437 | 153.64 | 15.36 |
| Selenium | East Fork | EFPC RI 1 | 0.4486 | 0.50 | 0.24 |
| Uranium | East Fork | EFPC RI 1 | 0.4599 | 0.01 | |
| Zinc | East Fork | EFPC RI 1 | 45.7947 | 1.35 | 0.15 |
| Antimony | East Fork | EFPC RI 2 | 0.0058 | | |
| Arsenic | East Fork | EFPC RI 2 | 0.1935 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 2 | 0.0127 | | |
| Chlordane | East Fork | EFPC RI 2 | 0.1809 | 0.11 | 0.02 |
| Chromium | East Fork | EFPC RI 2 | 2.4847 | 1.24 | 0.25 |
| DDE | East Fork | EFPC RI 2 | 0.1715 | 21.44 | 2.14 |
| Dieldrin | East Fork | EFPC RI 2 | 0.0642 | 0.57 | |
| Heptachlor, total | East Fork | EFPC RI 2 | 0.1578 | | |
| Lindane | East Fork | EFPC RI 2 | 0.0030 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 2 | 5.4484 | 454.03 | 45.40 |
| Selenium | East Fork | EFPC RI 2 | 0.5223 | 0.58 | 0.27 |
| Uranium | East Fork | EFPC RI 2 | 0.4279 | 0.01 | |

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Zinc | East Fork | EFPC RI 2 | 47.2543 | 1.39 | 0.15 |
| Aldrin | East Fork | EFK18.4 | 0.0000 | 0.00 | |
| BHC, total | East Fork | EFK18.4 | 0.0003 | 0.00 | 0.00 |
| Chlordane | East Fork | EFK18.4 | 0.2223 | 0.14 | 0.03 |
| DDT, total | East Fork | EFK18.4 | 0.0597 | 7.46 | 0.75 |
| Dieldrin | East Fork | EFK18.4 | 0.0300 | 0.27 | |
| Endrin | East Fork | EFK18.4 | 0.0000 | 0.00 | 0.00 |
| Mercury | East Fork | EFK18.2 | 0.3192 | 26.60 | 2.66 |
| MN_HG | East Fork | EFK18 | 0.2701 | 22.50 | 2.25 |
| Antimony | East Fork | EFPC RI 3 | 0.0055 | | |
| Arsenic | East Fork | EFPC RI 3 | 0.1461 | 0.02 | 0.01 |
| Benzo(a)pyrene | East Fork | EFPC RI 3 | 0.0074 | | |
| Chlordane | East Fork | EFPC RI 3 | 0.0573 | 0.04 | 0.01 |
| Chromium | East Fork | EFPC RI 3 | 1.2428 | 0.62 | 0.12 |
| DDE | East Fork | EFPC RI 3 | 0.0321 | 4.01 | 0.40 |
| Dieldrin | East Fork | EFPC RI 3 | 0.0267 | 0.24 | |
| Heptachlor, total | East Fork | EFPC RI 3 | 0.0773 | | |
| Lindane | East Fork | EFPC RI 3 | 0.0022 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 3 | 1.2330 | 102.75 | 10.27 |
| Selenium | East Fork | EFPC RI 3 | 0.3713 | 0.41 | 0.20 |
| Uranium | East Fork | EFPC RI 3 | 0.2851 | 0.01 | |
| Zinc | East Fork | EFPC RI 3 | 31.1314 | 0.92 | 0.10 |
| Mercury | East Fork | EFK13.8 | 0.2929 | 24.41 | 2.44 |
| Aldrin | East Fork | EFPC RI 4 | 0.0167 | 0.15 | |
| Antimony | East Fork | EFPC RI 4 | 0.0062 | | |
| Benzo(a)pyrene | East Fork | EFPC RI 4 | 0.0029 | | |
| BHC, total | East Fork | EFPC RI 4 | 0.1052 | 0.19 | 0.05 |
| Chlordane | East Fork | EFPC RI 4 | 0.0563 | 0.03 | 0.01 |
| Chromium | East Fork | EFPC RI 4 | 0.8051 | 0.40 | 0.08 |

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| DDE | East Fork | EFPC RI 4 | 0.0197 | 2.46 | 0.25 |
| Dieldrin | East Fork | EFPC RI 4 | 0.0373 | 0.33 | |
| Heptachlor, total | East Fork | EFPC RI 4 | 0.0772 | | |
| Lindane | East Fork | EFPC RI 4 | 0.0011 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 4 | 0.5500 | 45.84 | 4.58 |
| Selenium | East Fork | EFPC RI 4 | 0.4443 | 0.49 | 0.23 |
| Uranium | East Fork | EFPC RI 4 | 0.1947 | 0.01 | |
| Zinc | East Fork | EFPC RI 4 | 25.0102 | 0.74 | 0.08 |
| Aldrin | East Fork | EFPC RI 5 | 0.0188 | 0.17 | |
| Benzo(a)pyrene | East Fork | EFPC RI 5 | 0.0040 | | |
| BHC, total | East Fork | EFPC RI 5 | 0.1056 | 0.19 | 0.05 |
| Chlordane | East Fork | EFPC RI 5 | 0.0599 | 0.04 | 0.01 |
| Chromium | East Fork | EFPC RI 5 | 0.8457 | 0.42 | 0.08 |
| DDE | East Fork | EFPC RI 5 | 0.0142 | 1.77 | 0.18 |
| Dieldrin | East Fork | EFPC RI 5 | 0.0453 | 0.40 | |
| Heptachlor, total | East Fork | EFPC RI 5 | 0.0441 | | |
| Lindane | East Fork | EFPC RI 5 | 0.0021 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 5 | 0.4023 | 33.53 | 3.35 |
| Selenium | East Fork | EFPC RI 5 | 0.4226 | 0.47 | 0.22 |
| Zinc | East Fork | EFPC RI 5 | 24.9623 | 0.74 | 0.08 |
| Mercury | East Fork | EFK6.3 | 0.2359 | 19.66 | 1.97 |
| Benzo(a)pyrene | East Fork | EFPC RI 6 | 0.0003 | | |
| Chlordane | East Fork | EFPC RI 6 | 0.0284 | 0.02 | 0.00 |
| Chromium | East Fork | EFPC RI 6 | 0.4122 | 0.21 | 0.04 |
| Dieldrin | East Fork | EFPC RI 6 | 0.0218 | 0.19 | |
| Heptachlor, total | East Fork | EFPC RI 6 | 0.0243 | | |
| Lindane | East Fork | EFPC RI 6 | 0.0019 | 0.00 | 0.00 |
| Mercury | East Fork | EFPC RI 6 | 0.2340 | 19.50 | 1.95 |
| Selenium | East Fork | EFPC RI 6 | 0.3072 | 0.34 | 0.16 |

**Table C.14. Estimated exposure of great blue heron on the ORR to non-PCB contaminants**

| Analyte | Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Zinc | East Fork | EFPC RI 6 | 18.3291 | 0.54 | 0.06 |
| Mercury | East Fork | EFK2.1 | 0.1474 | 12.28 | 1.23 |
| Mercury | East Fork | EFK2 | 0.1953 | 16.28 | 1.63 |
| Mercury | K-25 | PCK18.2 | 0.0263 | 2.20 | 0.22 |
| Mercury | K-25 | PCK10.4 | 0.0592 | 4.93 | 0.49 |
| Mercury | K-25 | PCK8.2 | 0.1569 | 13.07 | 1.31 |
| Mercury | K-25 | MIK0.2 | 0.0931 | 7.76 | 0.78 |
| Mercury | K-25 | PCK6.9 | 0.1537 | 12.81 | 1.28 |
| Mercury | K-25 | PCK1.6 | 0.0861 | 7.17 | 0.72 |
| Mercury | K-25 | K-710 | 0.0461 | 3.84 | 0.38 |
| Mercury | K-25 | K-1007 | 0.0280 | 2.33 | 0.23 |
| Arsenic | K-25 | K-901 | 0.0808 | 0.02 | 0.01 |
| Chromium | K-25 | K-901 | 7.8377 | 9.80 | 1.96 |
| Copper | K-25 | K-901 | 0.3690 | 0.01 | 0.01 |
| Lead | K-25 | K-901 | 0.0914 | 0.06 | 0.02 |
| Mercury | K-25 | K-901 | 0.0088 | 1.76 | 0.18 |
| Nickel | K-25 | K-901 | 0.2812 | 0.01 | 0.00 |
| Selenium | K-25 | K-901 | 0.1054 | 0.26 | 0.13 |
| Zinc | K-25 | K-901 | 5.7113 | 0.42 | 0.05 |
| Mercury | White Oak | NTK0.2 | 0.0648 | 5.40 | 0.54 |
| Mercury | White Oak | WCK3.5 | 0.0924 | 7.70 | 0.77 |
| Mercury | White Oak | WCK2.9 | 0.1536 | 12.80 | 1.28 |
| Mercury | White Oak | MEK0.2 | 0.0461 | 3.84 | 0.38 |
| Mercury | White Oak | WCK2.3 | 0.1000 | 8.33 | 0.83 |
| Mercury | White Oak | WOL | 0.0590 | 4.91 | 0.49 |
| Mercury | White Oak | WCK0.9 | 0.0376 | 3.13 | 0.31 |
| Mercury | White Oak | WCK0.3 | 0.0646 | 5.38 | 0.54 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

**Table C.15. Estimated exposure of great blue heron on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| Bear Creek | BCK12.4 | 0.1072 | 0.77 | 0.08 |
| Bear Creek | BCK9.4 | 0.7908 | 5.65 | 0.59 |
| Bear Creek | BCK4.5 | 0.9160 | 6.54 | 0.68 |
| Bear Creek | BCK3.3 | 0.3075 | 2.20 | 0.23 |
| Bear Creek | BCK0.6 | 0.2260 | 1.61 | 0.17 |
| East Fork | EFK24.8 | 4.2286 | 30.20 | 3.13 |
| East Fork | EFK24.4 | 1.4203 | 10.14 | 1.05 |
| East Fork | EFK24 | 0.9024 | 6.45 | 0.67 |
| East Fork | EFK23.7 | 1.2677 | 9.06 | 0.94 |
| East Fork | EFK23.5 | 1.4817 | 10.58 | 1.10 |
| East Fork | EFK23.4 | 0.8765 | 6.26 | 0.65 |
| East Fork | EFPC RI 1[a] | 1.6217 | 11.58 | 1.20 |
| East Fork | EFPC RI 2 | 1.8858 | 13.47 | 1.40 |
| East Fork | EFK18.4 | 0.4792 | 3.42 | 0.35 |
| East Fork | EFK18.2 | 0.3177 | 2.27 | 0.24 |
| East Fork | EFPC RI 3 | 0.5329 | 3.81 | 0.39 |
| East Fork | EFK13.8 | 0.2380 | 1.70 | 0.18 |
| East Fork | EFPC RI 4 | 0.3117 | 2.23 | 0.23 |
| East Fork | EFPC RI 5 | 0.1995 | 1.42 | 0.15 |
| East Fork | EFK6.3 | 0.1469 | 1.05 | 0.11 |
| East Fork | EFPC RI 6 | 0.0826 | 0.59 | 0.06 |
| East Fork | EFK2.1 | 0.1436 | 1.03 | 0.11 |
| K-25 | PCK18.2 | 0.1125 | 0.80 | 0.08 |
| K-25 | PCK10.4 | 0.0687 | 0.49 | 0.05 |
| K-25 | PCK8.2 | 0.1232 | 0.88 | 0.09 |
| K-25 | MIK0.2 | 0.9992 | 7.14 | 0.74 |

**Table C.15. Estimated exposure of great blue heron on the ORR to PCBs**

| Drainage | Sampling station | Dietary exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|
| K-25 | PCK6.9 | 0.1743 | 1.25 | 0.13 |
| K-25 | PCK1.6 | 0.1671 | 1.19 | 0.12 |
| K-25 | K-1007 | 0.0615 | 0.44 | 0.05 |
| K-25 | K-901 | 2.6360 | 18.83 | 1.95 |
| White Oak | NTK0.2 | 0.2458 | 1.76 | 0.18 |
| White Oak | WCK3.5 | 0.5079 | 3.63 | 0.38 |
| White Oak | WCK2.9 | 0.4393 | 3.14 | 0.33 |
| White Oak | MEK0.2 | 0.2190 | 1.56 | 0.16 |
| White Oak | WCK2.3 | 0.4357 | 3.11 | 0.32 |
| White Oak | WOL | 0.4973 | 3.55 | 0.37 |
| White Oak | WCK0.9 | 0.3084 | 2.20 | 0.23 |
| White Oak | WCK0.3 | 0.2908 | 2.08 | 0.22 |

[a] EFPC RI 1 to 6 indicates data from East Fork Poplar Creek RI sampling locations 1 to 6. These locations are presented in the appropriate order relative to their distance from the confluence with Poplar Creek.

**Table C-16. Estimated exposure of piscivores at off-site locations**

| Endpoint | Analyte | Drainage | Dietary Exposure (mg/kg-d) | NOAEL HQ | LOAEL HQ |
|---|---|---|---|---|---|
| Mink | Mercury | Beaver Creek | 0.0043 | 0.29 | 0.04 |
| Mink | Mercury | Brushy Fork | 0.0061 | 0.41 | 0.06 |
| Mink | Mercury | Hinds Creek | 0.0031 | 0.20 | 0.03 |
| Otter | Mercury | Beaver Creek | 0.0516 | 6.45 | 0.86 |
| Otter | Mercury | Brushy Fork | 0.1042 | 13.02 | 1.74 |
| Otter | Mercury | Hinds Creek | 0.0510 | 6.37 | 0.85 |
| Belted Kingfisher | Mercury | Beaver Creek | 0.0290 | 2.42 | 0.24 |
| Belted Kingfisher | Mercury | Brushy Fork | 0.0413 | 3.44 | 0.34 |
| Belted Kingfisher | Mercury | Hinds Creek | 0.0207 | 2.41 | 0.24 |
| Great Blue Heron | Mercury | Beaver Creek | 0.0101 | 2.01 | 0.21 |
| Great Blue Heron | Mercury | Brushy Fork | 0.0143 | 2.86 | 0.30 |
| Great Blue Heron | Mercury | Hinds Creek | 0.0100 | 1.44 | 0.15 |
| Mink | PCB | Brushy Fork | 0.3686 | 2.63 | 0.53 |
| Mink | PCB | Hinds Creek | 0.0074 | 0.05 | 0.01 |
| Otter | PCB | Brushy Fork | 1.3137 | 18.77 | 3.75 |
| Otter | PCB | Hinds Creek | 0.0463 | 0.66 | 0.13 |
| Belted Kingfisher | PCB | Brushy Fork | 2.4971 | 7.34 | 0.73 |
| Belted Kingfisher | PCB | Hinds Creek | 0.0501 | 0.15 | 0.01 |
| Great Blue Heron | PCB | Brushy Fork | 0.8660 | 6.19 | 0.64 |
| Great Blue Heron | PCB | Hinds Creek | 0.0174 | 0.12 | 0.01 |
| Mink | Selenium | Hinds Creek | 0.0338 | 1.41 | 0.14 |
| Mink | Cadmium | Hinds Creek | 0.0021 | 0.35 | 0.30 |
| Otter | Selenium | Hinds Creek | 0.0509 | 4.24 | 0.42 |
| Otter | Cadmium | Hinds Creek | 0.0032 | 1.05 | 0.79 |
| Belted Kingfisher | DDT | Hinds Creek | 0.5169 | 0.26 | 0.05 |
| Belted Kingfisher | Chromium | Hinds Creek | 0.0036 | 0.45 | 0.05 |
| Great Blue Heron | DDT | Hinds Creek | 0.1792 | 0.22 | 0.04 |
| Great Blue Heron | Chromium | Hinds Creek | 0.0013 | 0.39 | 0.04 |

Table C.17. Results of Monte Carlo simulation of exposure for piscivores on the ORR

| Location | Analyte | Species | Number of sampling locations | Mean | Standard deviation | 80th percentile | % > NOAEL | % > LOAEL |
|---|---|---|---|---|---|---|---|---|
| Bear Creek | Cadmium | Mink | 3 | 0.064 | 0.031 | 0.086 | >99% | >99% |
| White Oak Creek | Cadmium | Mink | 3 | 0.001 | 0.001 | 0.002 | <1% | <1% |
| Hinds Creek | Cadmium | Mink | 1 | 0.002 | 0.001 | 0.002 | <1% | <1% |
| | | | | | | | | |
| Bear Creek | Mercury | Mink | 5 | 0.013 | 0.006 | 0.017 | 30% | <1% |
| East Fork Poplar Creek | Mercury | Mink | 20 | 0.067 | 0.029 | 0.089 | ~99% | 5-10% |
| East Fork Poplar Creek (w/o EFPC RI data) | Mercury | Mink | 14 | 0.056 | 0.026 | 0.077 | >95% | <5% |
| K-25 | Mercury | Mink | 8 | 0.011 | 0.005 | 0.014 | 15-20% | <1% |
| White Oak Creek | Mercury | Mink | 8 | 0.011 | 0.005 | 0.015 | ~20% | <1% |
| Beaver Creek | Mercury | Mink | 1 | 0.003 | 0.002 | 0.004 | <1% | <1% |
| Brushy Fork | Mercury | Mink | 1 | 0.005 | 0.003 | 0.007 | <5% | <1% |
| Hinds Creek | Mercury | Mink | 1 | 0.003 | 0.001 | 0.004 | <5% | <1% |
| | | | | | | | | |
| Bear Creek | PCB | Mink | 5 | 0.145 | 0.068 | 0.195 | 45-50% | <1% |
| East Fork Poplar Creek | PCB | Mink | 20 | 0.307 | 0.147 | 0.409 | 90% | <5% |
| East Fork Poplar Creek (w/o EFPC RI data) | PCB | Mink | 14 | 0.352 | 0.165 | 0.476 | 90-95% | <5% |
| K-25 | PCB | Mink | 8 | 0.137 | 0.067 | 0.181 | 40-45% | <1% |
| White Oak Creek | PCB | Mink | 8 | 0.130 | 0.061 | 0.174 | 35-40% | <1% |
| Brushy Fork | PCB | Mink | 1 | 0.247 | 0.135 | 0.350 | 80% | <5% |
| Hinds Creek | PCB | Mink | 1 | 0.009 | 0.004 | 0.012 | <1% | <1% |
| | | | | | | | | |
| Bear Creek | Selenium | Mink | 3 | 0.043 | 0.020 | 0.059 | 80-85% | <1% |
| Hinds Creek | Selenium | Mink | 1 | 0.033 | 0.015 | 0.045 | 70-75% | <1% |
| | | | | | | | | |
| Bear Creek | Cadmium | Otter | 3 | 0.101 | 0.012 | 0.111 | >99% | >99% |
| White Oak Creek | Cadmium | Otter | 3 | 0.002 | 0.000 | 0.003 | ~1% | <1% |
| Hinds Creek | Cadmium | Otter | 1 | 0.003 | 0.000 | 0.003 | 15% | <5% |

**Table C.17. Results of Monte Carlo simulation of exposure for piscivores on the ORR**

| Location | Analyte | Species | Number of sampling locations | Mean | Standard deviation | 80th percentile | % > NOAEL | % > LOAEL |
|---|---|---|---|---|---|---|---|---|
| Bear Creek | Mercury | Otter | 5 | 0.018 | 0.002 | 0.020 | >99% | <1% |
| East Fork Poplar Creek | Mercury | Otter | 20 | 0.077 | 0.013 | 0.088 | >99% | 90-95% |
| East Fork Poplar Creek (w/o EFPC RI data) | Mercury | Otter | 14 | 0.059 | 0.007 | 0.065 | >99% | 40% |
| K-25 | Mercury | Otter | 8 | 0.013 | 0.002 | 0.014 | >99% | <1% |
| White Oak Creek | Mercury | Otter | 8 | 0.013 | 0.002 | 0.015 | >99% | <1% |
| Beaver Creek | Mercury | Otter | 1 | 0.005 | 0.001 | 0.005 | <1% | <1% |
| Brushy Fork | Mercury | Otter | 1 | 0.010 | 0.002 | 0.011 | 85% | <1% |
| Hinds Creek | Mercury | Otter | 1 | 0.006 | 0.001 | 0.006 | <1% | <1% |
| Bear Creek | PCB | Otter | 5 | 0.204 | 0.031 | 0.230 | >99% | <1% |
| East Fork Poplar Creek | PCB | Otter | 20 | 0.488 | 0.069 | 0.544 | >99% | >95% |
| East Fork Poplar Creek (w/o EFPC RI data) | PCB | Otter | 14 | 0.542 | 0.083 | 0.614 | >99% | >99% |
| K-25 | PCB | Otter | 8 | 0.411 | 0.125 | 0.514 | >95% | 65-70% |
| White Oak Creek | PCB | Otter | 8 | 0.202 | 0.056 | 0.245 | >95% | <5% |
| Brushy Fork | PCB | Otter | 1 | 0.680 | 0.257 | 0.895 | 90-95% | >99% |
| Hinds Creek | PCB | Otter | 1 | 0.031 | 0.010 | 0.040 | <1% | <1% |
| Bear Creek | Selenium | Otter | 3 | 0.061 | 0.008 | 0.068 | >99% | <1% |
| Hinds Creek | Selenium | Otter | 1 | 0.047 | 0.006 | 0.052 | >99% | <1% |
| K-901 | Chromium | Belted Kingfisher | 1 | 7.860 | 2.776 | 9.916 | >95% | 15-20% |
| Hinds Creek | Chromium | Belted Kingfisher | 1 | 0.373 | 0.070 | 0.425 | <1% | <1% |

**Table C.17. Results of Monte Carlo simulation of exposure for piscivores on the ORR**

| Location | Analyte | Species | Number of sampling locations | Mean | Standard deviation | 80th percentile | % > NOAEL | % > LOAEL |
|---|---|---|---|---|---|---|---|---|
| East Fork Poplar Creek | DDT | Belted Kingfisher | 8 | 0.051 | 0.013 | 0.061 | >99% | <5% |
| Hinds Creek | DDT | Belted Kingfisher | 1 | 0.003 | 0.001 | 0.003 | <1% | <1% |
| Bear Creek | Mercury | Belted Kingfisher | 5 | 0.081 | 0.013 | 0.090 | >99% | <1% |
| East Fork Poplar Creek | Mercury | Belted Kingfisher | 20 | 0.501 | 0.101 | 0.577 | >99% | >99% |
| East Fork Poplar Creek (w/o EFPC RI data) | Mercury | Belted Kingfisher | 14 | 0.372 | 0.060 | 0.415 | >99% | >99% |
| K-25 | Mercury | Belted Kingfisher | 8 | 0.067 | 0.011 | 0.075 | >99% | <1% |
| White Oak Creek | Mercury | Belted Kingfisher | 8 | 0.072 | 0.011 | 0.080 | >99% | <1% |
| Beaver Creek | Mercury | Belted Kingfisher | 1 | 0.021 | 0.005 | 0.025 | >95% | <1% |
| Brushy Fork | Mercury | Belted Kingfisher | 1 | 0.031 | 0.008 | 0.037 | >95% | <1% |
| Hinds Creek | Mercury | Belted Kingfisher | 1 | 0.018 | 0.003 | 0.020 | >95% | <1% |
| Bear Creek | PCB | Belted Kingfisher | 5 | 0.932 | 0.157 | 1.055 | >99% | <1% |
| East Fork Poplar Creek | PCB | Belted Kingfisher | 20 | 1.936 | 0.328 | 2.205 | >99% | <1% |
| East Fork Poplar Creek (w/o EFPC RI data) | PCB | Belted Kingfisher | 14 | 2.293 | 0.443 | 2.635 | >99% | <5% |
| K-25 | PCB | Belted Kingfisher | 8 | 0.874 | 0.165 | 0.999 | >99% | <1% |
| White Oak Creek | PCB | Belted Kingfisher | 8 | 0.825 | 0.121 | 0.916 | >99% | <1% |
| Brushy Fork | PCB | Belted Kingfisher | 1 | 1.588 | 0.441 | 1.952 | >99% | <1% |

**Table C.17. Results of Monte Carlo simulation of exposure for piscivores on the ORR**

| Location | Analyte | Species | Number of sampling locations | Mean | Standard deviation | 80th percentile | % > NOAEL | % > LOAEL |
|---|---|---|---|---|---|---|---|---|
| Hinds Creek | PCB | Belted Kingfisher | 1 | 0.056 | 0.008 | 0.062 | <1% | <1% |
| K-901 | Chromium | Great Blue Heron | 1 | 2.926 | 1.070 | 3.792 | >95% | 15-20% |
| Hinds Creek | Chromium | Great Blue Heron | 1 | 0.142 | 0.029 | 0.162 | <1% | <1% |
| East Fork Poplar Creek | DDT | Great Blue Heron | 8 | 0.019 | 0.005 | 0.023 | >99% | <5% |
| Hinds Creek | DDT | Great Blue Heron | 1 | 0.001 | 0.000 | 0.001 | <1% | <1% |
| Bear Creek | Mercury | Great Blue Heron | 5 | 0.030 | 0.005 | 0.034 | >99% | <5% |
| East Fork Poplar Creek | Mercury | Great Blue Heron | 20 | 0.187 | 0.039 | 0.216 | >99% | >99% |
| East Fork Poplar Creek (w/o EFPC RI data) | Mercury | Great Blue Heron | 14 | 0.140 | 0.024 | 0.158 | >99% | >99% |
| K-25 | Mercury | Great Blue Heron | 8 | 0.025 | 0.004 | 0.028 | >99% | <5% |
| White Oak Creek | Mercury | Great Blue Heron | 8 | 0.027 | 0.005 | 0.030 | >99% | <5% |
| Beaver Creek | Mercury | Great Blue Heron | 1 | 0.008 | 0.002 | 0.009 | >95% | <1% |
| Brushy Fork | Mercury | Great Blue Heron | 1 | 0.012 | 0.003 | 0.014 | >95% | <1% |
| Hinds Creek | Mercury | Great Blue Heron | 1 | 0.007 | 0.001 | 0.008 | >95% | <1% |
| Bear Creek | PCB | Great Blue Heron | 5 | 0.353 | 0.067 | 0.402 | >99% | <1% |
| East Fork Poplar Creek | PCB | Great Blue Heron | 20 | 0.739 | 0.143 | 0.851 | >99% | <1% |

**Table C.17. Results of Monte Carlo simulation of exposure for piscivores on the ORR**

| Location | Analyte | Species | Number of sampling locations | Mean | Standard deviation | 80th percentile | % > NOAEL | % > LOAEL |
|---|---|---|---|---|---|---|---|---|
| East Fork Poplar Creek (w/o EFPC RI data) | PCB | Great Blue Heron | 14 | 0.856 | 0.169 | 0.973 | >99% | <5% |
| K-25 | PCB | Great Blue Heron | 8 | 0.331 | 0.067 | 0.380 | >99% | <1% |
| White Oak Creek | PCB | Great Blue Heron | 8 | 0.315 | 0.051 | 0.350 | >99% | <1% |
| Brushy Fork | PCB | Great Blue Heron | 1 | 0.597 | 0.178 | 0.735 | >99% | <1% |
| Hinds Creek | PCB | Great Blue Heron | 1 | 0.021 | 0.004 | 0.024 | <1% | <1% |

Table C.18. Estimated NOAELs and LOAELs for mink and river otter

| Contaminant | Experimental information | | | | | | Estimated NOAEL (mg/kg/d) | | Estimated LOAEL (mg/kg/d) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | mink | otter | mink | otter |
| Antimony | antimony potassium tartrate | mouse | 0.125 lifetime | 1.25 lifetime | reproduction | Schroeder et al. 1968 | 0.04 | 0.02 | 0.4 | 0.2 |
| Arsenic | As+3 | mouse | 0.126[1] 3 gen. | 1.26 3 gen. | reproduction | Schroeder and Mitchner 1971 | 0.04 | 0.02 | 0.4 | 0.2 |
| Beryllium | sulfate | rat | 0.66 1126 d | | longevity/ wt. loss | Schroeder and Mitchner 1975 | 0.47 | 0.24 | | |
| Cadmium | $CdCl_2$ | rat | 0.008 4 gen. | 0.01 4 gen. | reproduction | Wills et al. 1981 | 0.006 | 0.003 | 0.007 | 0.004 |
| Chromium | $Cr^{+6}$ | rat | 3.28 1 yr | | wt. loss, food consumption | Mackenzie et al. 1958 | 2.32 | 1.17 | | |
| Chromium | $Cr^{+6}$ | rat | | 13.14[2] 3 mo. | Mortality | Steven et al. 1976 | | | 9.3 | 4.7 |
| Copper | sulfate | mink | 11.71 1 yr | 15.14 1 yr | reproduction | Aulerich et al. 1982 | 11.7 | 5.9 | 15.1 | 7.6 |
| Lead | acetate | rat | 8 3 gen. | 80 3 gen. | reproduction | Azar et al. 1973 | 5.7 | 2.8 | 57 | 28 |
| Lithium | carbonate | rat | 9.4 gest | 18.8 gest | reproduction | Marathe and Thomas 1986 | 6.6 | 3.3 | 13 | 6.7 |
| Mercury | methyl | mink | 0.015[2] 93 d | | mortality | Wobeser et al. 1976 | 0.015 | 0.008 | | |

Table C.18. Estimated NOAEL's and LOAEL's for mink and river otter

| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) mink | Estimated NOAEL (mg/kg/d) otter | Estimated LOAEL (mg/kg/d) mink | Estimated LOAEL (mg/kg/d) otter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Experimental information | | | | | | | |
| Mercury | methyl | rat | | 0.16<br>3 gen. | reproduction | Verschuuren et al. 1976 | | | 0.11 | 0.06 |
| Nickel | sulfate | rat | 40<br>3 gen. | 80<br>3 gen. | reproduction | Ambrose et al. 1976 | 28.3 | 14.2 | 57 | 28.5 |
| Selenium | selenate | mouse | 0.075[1]<br>3 gen | 0.75<br>3 gen | reproduction | Schroeder and Mitchner 1971 | 0.024 | 0.012 | 0.24 | 0.12 |
| Thallium | sulfate | rat | 0.0074[1,2]<br>60 d | 0.074[1,2]<br>60 d | reproduction | Formigli et al. 1986 | 0.005 | 0.003 | 0.053 | 0.027 |
| Uranium | acetate | mouse | 3.07<br>gest. | 6.13<br>gest. | reproduction. | Paternain et al. 1989 | 0.94 | 0.48 | 1.9 | 1 |
| Zinc | oxide | rat | 160<br>gestation | 320<br>gestation | reproduction | Schlicker and Cox 1968 | 113.2 | 57 | 226.3 | 114 |
| Aldrin | | rat | 0.2<br>3 gen | 1.0<br>3 gen | reproduction | Treon and Cleveland 1955 | 0.14 | 0.07 | 0.7 | 0.36 |
| Benzo(a)pyrene | | mouse | 1<br>gest. | 10<br>gest. | reproduction | Mackenzie and Angevine 1981 | 0.31 | 0.16 | 3.1 | 1.6 |
| BHC (mixed isomers) | | mink | 0.014<br>331 d | 0.14<br>331 d. | reproductionre production | Bleavins et al. 1984 | 0.014 | 0.007 | 0.14 | 0.07 |
| Chlordane | | mouse | 4.6<br>6 gen | 9.2<br>6 gen | reproduction | WHO 1984 | 1.4 | 0.73 | 2.9 | 1.5 |
| DDT and metabolites | | rat | 0.8<br>2 yr | 4.0<br>2 yr | reproduction | Fitzhugh 1948 | 0.57 | 0.29 | 2.8 | 1.4 |

**Table C.18. Estimated NOAEL's and LOAEL's for mink and river otter**

| Contaminant | Experimental information: Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | | Estimated LOAEL (mg/kg/d) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | mink | otter | mink | otter |
| Dieldrin | | rat | 0.02<br>3 gen | 0.2<br>3 gen. | reproduction | Treon and Cleveland1955 | 0.014 | 0.007 | 0.14 | 0.07 |
| Endosulfan | | rat | 0.15[2]<br>30 d | | reproduction | Dikshith et al. 1984 | 0.11 | 0.053 | | |
| Endrin | | mouse | 0.092[1]<br>120 d | 0.92<br>120 d | reproduction | Good and Ware 1969 | 0.029 | 0.015 | 0.29 | 0.15 |
| Heptachlor | | mink | 0.1[1]<br>181 d | 1<br>181 d. | reproduction | Crum et al. 1993 | 0.1 | 0.05 | 1 | 0.5 |
| Lindane | | rat | 8<br>3 gen. | | reproduction | Palmer et al. 1978 | 5.7 | 2.8 | | |
| PCB's | Aroclor 1254 | mink | 0.137<br>4.5 mo. | 0.685<br>4.5 mo. | reproduction | Aulerich and Ringer 1987 | 0.14 | 0.07 | 0.69 | 0.35 |

[1] Estimated NOAEL: LOAEL to NOAEL factor of 10 applied.
[2] Estimated NOAEL: subchronic to chronic factor of 10 applied.

Table C.19. Estimated NOAEL's and LOAEL's for belted kingfisher and great blue heron

| Contaminant | Experimental information | | | | | | Estimated NOAEL (mg/kg/d) | | Estimated LOAEL (mg/kg/d) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Belted king-fisher | Great blue heron | Belted king-fisher | Great blue heron |
| Arsenic | arsenite | mallard duck | 5.14 128d | 12.84 128d | mortality | USFWS 1964 | 9.65 | 3.9 | 24.1 | 9.6 |
| Cadmium | $CdCl_2$ | mallard duck | 1.45 90 d | 20 90 d | reproduction | White and Finley 1978 | 2.9 | 1.1 | 39 | 16 |
| Chromium | $Cr^{+3}$ | black duck | 1 10 mo. | 5 10 mo. | reproduction | Haseltine et al., unpubl. data | 2 | 0.8 | 10.1 | 4 |
| Copper | oxide | chicken | 33.2 10 wk | 46.97 10 wk | growth/ mortality | Mehring et al. 1960 | | 20.25 | | 28.6 |
| Lead | metal | American Kestrel | 3.85 7 mo. | | reproduction | Pattee 1984 | 3.69 | 1.47 | | |
| Lithium | acetate | Japanese quail | | 11.3 12 wk | reproduction | Edens et al. 1976 | | | 11 | 5 |
| Mercury | methyl | mallard duck | 0.0064[2] 3 gen. | 0.064 3 gen. | reproduction | Heinz 1979 | 0.012 | 0.005 | 0.12 | 0.048 |
| Nickel | sulfate | mallard duck | 77.4 90 d | 107 90 d | mortality, growth, behavior | Cain and Pafford 1981 | 134.1 | 53.5 | 185 | 74 |
| Selenium | selenite | mallard duck | 0.5 10 wk | 1.0 10 wk | reproduction | Heinz et al. 1987 | 0.9 | 0.4 | 1.9 | 0.8 |
| Uranium | depleted metal | black duck | 16[2] 6 wk | | mortality, growth, behavior | Haseltine and Sileo 1983 | 32 | 13 | | |

Table C.19. Estimated NOAEL's and LOAEL's for belted kingfisher and great blue heron

| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) Belted kingfisher | Estimated NOAEL (mg/kg/d) Great blue heron | Estimated LOAEL (mg/kg/d) Belted kingfisher | Estimated LOAEL (mg/kg/d) Great blue heron |
|---|---|---|---|---|---|---|---|---|---|---|
| Zinc | zinc sulfate | chicken | 14.5<br>44 wk | 130.9<br>44 wk | reproduction | Stahl et al. 1990 | 33.9 | 13.5 | 306 | 122 |
| BHC (mixed isomers) | | Japanese Quail | 0.56<br>90 d | 2.25<br>90 d | reproduction | Vos et al. 1971 | 0.56 | 0.22 | 2.26 | 0.9 |
| Chlordane | | redwinged blackbird | 2.14<br>84 d | 10.7<br>84 d | mortality | Stickel et al. 1983 | 1.62 | 0.65 | 8.1 | 3.2 |
| DDT and metabolites | | Brown Pelican | 0.0028[3]<br>>1 yr | 0.028[3]<br>>1 yr | reproduction | Anderson et al. 1975 | 0.008 | 0.003 | 0.08 | 0.03 |
| Dieldrin | | barn owl | 0.077<br>2 yr | | reproduction | Mendenhall et al. 1983 | 0.045 | 0.045 | | |
| Endosulfan | | gray partridge | 10<br>4 wk | | reproduction | Abiola 1992 | 14 | 6 | | |
| Endrin | | screech owl | 0.01[1]<br>83 d | 0.1<br>83 d | reproduction | Fleming et al. 1982 | 0.011. | 0.004 | 0.11 | 0.04 |
| Lindane | | mallard duck | 2[1]<br>8 wk | 20<br>8 wk | reproduction | Chakravarty and Lahiri 1986 | 3.8 | 1.5 | 38 | 15 |
| PCB's | Aroclor 1254 | Ring-necked Pheasant | 0.18[2]<br>17 wk | 0.18<br>17 wk | reproduction | Dahlgren et al. 1972 | 0.34 | 0.14 | 3.4 | 1.4 |

[1] Estimated NOAEL: LOAEL to NOAEL factor of 10 applied.
[2] Estimated NOAEL: subchronic to chronic factor of 10 applied.

**Table C.20. Summary of analytes where HQs>1 were observed**

| Watershed | Endpoint | Analyte | No. locations where NOAEL-based HQ>1 | No. locations where LOAEL-based HQ>1 |
|---|---|---|---|---|
| Bear Creek | Mink | As | 1 | 0 |
| | | Cd | 3 | 3 |
| | | Hg | 2 | 0 |
| | | Se | 3 | 0 |
| | | PCBs | 2 | 0 |
| | River Otter | As | 3 | 0 |
| | | Cd | 3 | 3 |
| | | Hg | 5 | 0 |
| | | Se | 3 | 1 |
| | | Tl | 1 | 0 |
| | | PCBs | 4 | 2 |
| | Kingfisher | Hg | 4 | 1 |
| | | Zn | 1 | 0 |
| | | PCBs | 4 | 0 |
| | Heron | Hg | 5 | 2 |
| | | Zn | 1 | 0 |
| | | PCBs | 4 | 0 |
| East Fork Poplar Creek | Mink | Hg | 18 | 4 |
| | | Se | 6 | 0 |
| | | BHC | 2 | 0 |
| | | PCBs | 10 | 3 |
| | Otter | As | 3 | 0 |
| | | Hg | 19 | 10 |
| | | Se | 6 | 0 |
| | | BHC | 2 | 0 |
| | | Dieldrin | 4 | 0 |
| | | PCBs | 17 | 12 |
| | Kingfisher | Cr | 1 | 0 |

**Table C.20. Summary of analytes where HQs>1 were observed**

| Watershed | Endpoint | Analyte | No. locations where NOAEL-based HQ>1 | No. locations where LOAEL-based HQ>1 |
|---|---|---|---|---|
| | | Hg | 18 | 18 |
| | | Zn | 2 | 0 |
| | | DDT | 8 | 2 |
| | | PCBs | 16 | 6 |
| | Heron | Cr | .1 | 0 |
| | | Hg | 18 | 18 |
| | | Zn | 2 | 0 |
| | | DDT | 8 | 2 |
| | | PCBs | 16 | 5 |
| K-25 | Mink | Cr | 1 | 0 |
| | | Hg | 2 | 0 |
| | | Se | 1 | 0 |
| | | PCBs | 2 | 1 |
| | Otter | As | 1 | 0 |
| | | Cd | 1 | 1 |
| | | Cr | 1 | 0 |
| | | Hg | 6 | 0 |
| | | Se | 1 | 0 |
| | | PCBs | 6 | 4 |
| | Kingfisher | Cr | 1 | 1 |
| | | Hg | 9 | 2 |
| | | PCBs | 5 | 1 |
| | Heron | Cr | 1 | 1 |
| | | Hg | 9 | 3 |
| | | PCBs | 4 | 1 |
| White Oak Creek | Mink | Hg | 1 | 0 |
| | | PCBs | 4 | 0 |
| | Otter | Hg | 8 | 0 |

Table C.20. Summary of analytes where HQs>1 were observed

| Watershed | Endpoint | Analyte | No. locations where NOAEL-based HQ>1 | No. locations where LOAEL-based HQ>1 |
|---|---|---|---|---|
| | | PCBs | 8 | 1 |
| | Kingfisher | Hg | 8 | 1 |
| | | PCBs | 8 | 0 |
| | Heron | Hg | 8 | 1 |
| | | PCBs | 8 | 0 |
| Beaver Creek | Otter | Hg | 1 | 0 |
| | Kingfisher | Hg | 1 | 0 |
| | Heron | Hg | 1 | 0 |
| Brushy Fork | Mink | PCB | 1 | 0 |
| | Otter | Hg | 1 | 1 |
| | | PCB | 1 | 1 |
| | Kingfisher | Hg | 1 | 0 |
| | | PCB | 1 | 0 |
| | Heron | Hg | 1 | 0 |
| | | PCB | 1 | 0 |
| Hinds Creek | Mink | Se | 1 | 0 |
| | Otter | Cd | 1 | 0 |
| | | Hg | 1 | 0 |
| | | Se | 1 | 0 |
| | Kingfisher | Hg | 1 | 0 |
| | Heron | Hg | 1 | 0 |

**Table C.21. Summary of number of individuals of piscivore endpoint species estimated to be experiencing adverse effects by watershed and for the ORR**

| Location | Analyte | Species | % > LOAEL | Number in watershed | Number adversely affected | Percent adversely affected |
|---|---|---|---|---|---|---|
| Bear Creek | Cadmium | Mink | >99% | 7 | 7 | 100 |
| White Oak Creek | Cadmium | Mink | <1% | 4 | 0 | 0 |
| ORR-wide | Cadmium | Mink | | 40 | 7 | 17.5 |
| | | | | | | |
| Bear Creek | Mercury | Mink | <1% | 7 | 0 | 0 |
| East Fork Poplar Creek | Mercury | Mink | 5-10% | 15 | 0 | 0 |
| K-25 | Mercury | Mink | <1% | 14 | 0 | 0 |
| White Oak Creek | Mercury | Mink | <1% | 4 | 0 | 0 |
| ORR-wide | Mercury | Mink | | 40 | 0 | 0 |
| | | | | | | |
| Bear Creek | PCB | Mink | <1% | 7 | 0 | 0 |
| East Fork Poplar Creek | PCB | Mink | <5% | 15 | 0 | 0 |
| K-25 | PCB | Mink | <1% | 14 | 0 | 0 |
| White Oak Creek | PCB | Mink | <1% | 4 | 0 | 0 |
| ORR-wide | PCB | Mink | | 40 | 0 | 0 |
| | | | | | | |
| Bear Creek | Selenium | Mink | <1% | 7 | 0 | 0 |
| ORR-wide | PCB | Mink | | 40 | 0 | 0 |
| | | | | | | |
| Bear Creek | Cadmium | Otter | >99% | 5 | 5 | 100 |
| White Oak Creek | Cadmium | Otter | <1% | 2 | 0 | 0 |
| ORR-wide | Cadmium | Otter | | 25 | 5 | 20 |
| | | | | | | |
| Bear Creek | Mercury | Otter | <1% | 5 | 0 | 0 |
| East Fork Poplar Creek | Mercury | Otter | 90-95% | 9 | 9 | 100 |
| East Fork Poplar Creek (w/o EFPC RI data) | Mercury | Otter | 40% | 9 | 3 | 33 |
| K-25 | Mercury | Otter | <1% | 9 | 0 | 0 |

**Table C.21. Summary of number of individuals of piscivore endpoint species estimated to be experiencing adverse effects by watershed and for the ORR**

| Location | Analyte | Species | % > LOAEL | Number in watershed | Number adversely affected | Percent adversely affected |
|---|---|---|---|---|---|---|
| White Oak Creek | Mercury | Otter | <1% | 2 | 0 | 0 |
| ORR-wide | Mercury | Otter | | 25 | 3 or 9 | 12 or 36 |
| Bear Creek | PCB | Otter | <1% | 5 | 0 | 0 |
| East Fork Poplar Creek | PCB | Otter | >95% | 9 | 9 | 100 |
| K-25 | PCB | Otter | 65-70% | 9 | 6 | 66 |
| White Oak Creek | PCB | Otter | <5% | 2 | 0 | 0 |
| ORR-wide | PCB | Otter | | 25 | 15 | 60 |
| Bear Creek | Selenium | Otter | <1% | 5 | 0 | 0 |
| ORR-wide | Selenium | Otter | | 25 | 0 | 0 |
| East Fork Poplar Creek | DDT | Belted Kingfisher | <5% | 10 | 0 | 0 |
| ORR-wide | DDT | Belted Kingfisher | | 27 | 0 | 0 |
| Bear Creek | Mercury | Belted Kingfisher | <1% | 5 | 0 | 0 |
| East Fork Poplar Creek | Mercury | Belted Kingfisher | >99% | 10 | 10 | 100 |
| K-25 | Mercury | Belted Kingfisher | <1% | 9 | 0 | 0 |
| White Oak Creek | Mercury | Belted Kingfisher | <1% | 3 | 0 | 0 |
| ORR-wide | Mercury | Belted Kingfisher | | 27 | 10 | 37 |
| Bear Creek | PCB | Belted Kingfisher | <1% | 5 | 0 | 0 |

**Table C.21. Summary of number of individuals of piscivore endpoint species estimated to be experiencing adverse effects by watershed and for the ORR**

| Location | Analyte | Species | % > LOAEL | Number in watershed | Number adversely affected | Percent adversely affected |
|---|---|---|---|---|---|---|
| East Fork Poplar Creek | PCB | Belted Kingfisher | <1% | 10 | 0 | 0 |
| K-25 | PCB | Belted Kingfisher | <1% | 9 | 0 | 0 |
| White Oak Creek | PCB | Belted Kingfisher | <1% | 3 | 0 | 0 |
| ORR-wide | PCB | Belted Kingfisher | | 27 | 0 | 0 |
| East Fork Poplar Creek | DDT | Great Blue Heron | <5% | 57 | 0 | 0 |
| ORR-wide | DDT | Great Blue Heron | | 155 | 0 | 0 |
| Bear Creek | Mercury | Great Blue Heron | <5% | 29 | 0 | 0 |
| East Fork Poplar Creek | Mercury | Great Blue Heron | >99% | 57 | 57 | 100 |
| K-25 | Mercury | Great Blue Heron | <5% | 34 | 0 | 0 |
| White Oak Creek | Mercury | Great Blue Heron | <5% | 15 | 0 | 0 |
| Beaver Creek | Mercury | Great Blue Heron | <1% | 155 | 57 | 37 |
| Bear Creek | PCB | Great Blue Heron | <1% | 29 | 0 | 0 |
| East Fork Poplar Creek | PCB | Great Blue Heron | <1% | 57 | 0 | 0 |
| K-25 | PCB | Great Blue Heron | <1% | 34 | 0 | 0 |
| White Oak Creek | PCB | Great Blue Heron | <1% | 15 | 0 | 0 |

**Table C.21. Summary of number of individuals of piscivore endpoint species estimated to be experiencing adverse effects by watershed and for the ORR**

| Location | Analyte | Species | % > LOAEL | Number in watershed | Number adversely affected | Percent adversely affected |
|---|---|---|---|---|---|---|
| Brushy Fork | PCB | Great Blue Heron | <1% | 155 | 0 | 0 |

**Table C.22. Simulation of exposure of mink to mercury and PCBs in toxicity test diets**

| Diet | Analyte | Concentration in diet | | | | Distribution used in simulation | Modeled exposure (mg/kg-d) | | | % > NOAEL[a] | % > LOAEL[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | STD | Min | Max | | Mean | STD | 80th percentile | | |
| A | Mercury | 0.02 | 0 | 0.02 | 0.03 | Triangular | 0.0034 | 0.0009 | 0.0042 | <1% | 0% |
| B | Mercury | 0.05 | 0 | 0.04 | 0.06 | Triangular | 0.0074 | 0.0019 | 0.0088 | 1-5% | <0.01% |
| C | Mercury | 0.09 | 0 | 0.08 | 0.11 | Triangular | 0.0138 | 0.0035 | 0.016 | 30% | <0.01% |
| D | Mercury | 0.15 | 0.01 | | | Normal | 0.022 | 0.0059 | 0.026 | 90-95% | <0.01% |
| E | Mercury | 0.22 | 0.01 | | | Normal | 0.033 | 0.008 | 0.038 | >99% | <1% |
| A | PCB 1260 | 0.169 | 0.002 | | | Normal | 0.025 | 0.0063 | 0.029 | <1% | <1% |
| B | PCB 1260 | 11.44 | 0.327 | | | Normal | 1.70 | 0.43 | 1.97 | >99% | >99% |
| C | PCB 1260 | 4.697 | 0.174 | | | Normal | 0.698 | 0.18 | 0.82 | >99% | 40-45% |
| D | PCB 1260 | 10.41 | 0.25 | | | Normal | 1.54 | 0.39 | 1.79 | >99% | >99% |
| E | PCB 1260 | 20.67 | 0.458 | | | Normal | 3.07 | 0.77 | 3.55 | >99% | >99% |

[a] PCB 1260 evaluated by comparison to NOAEL and LOAEL for Aroclor 1254.

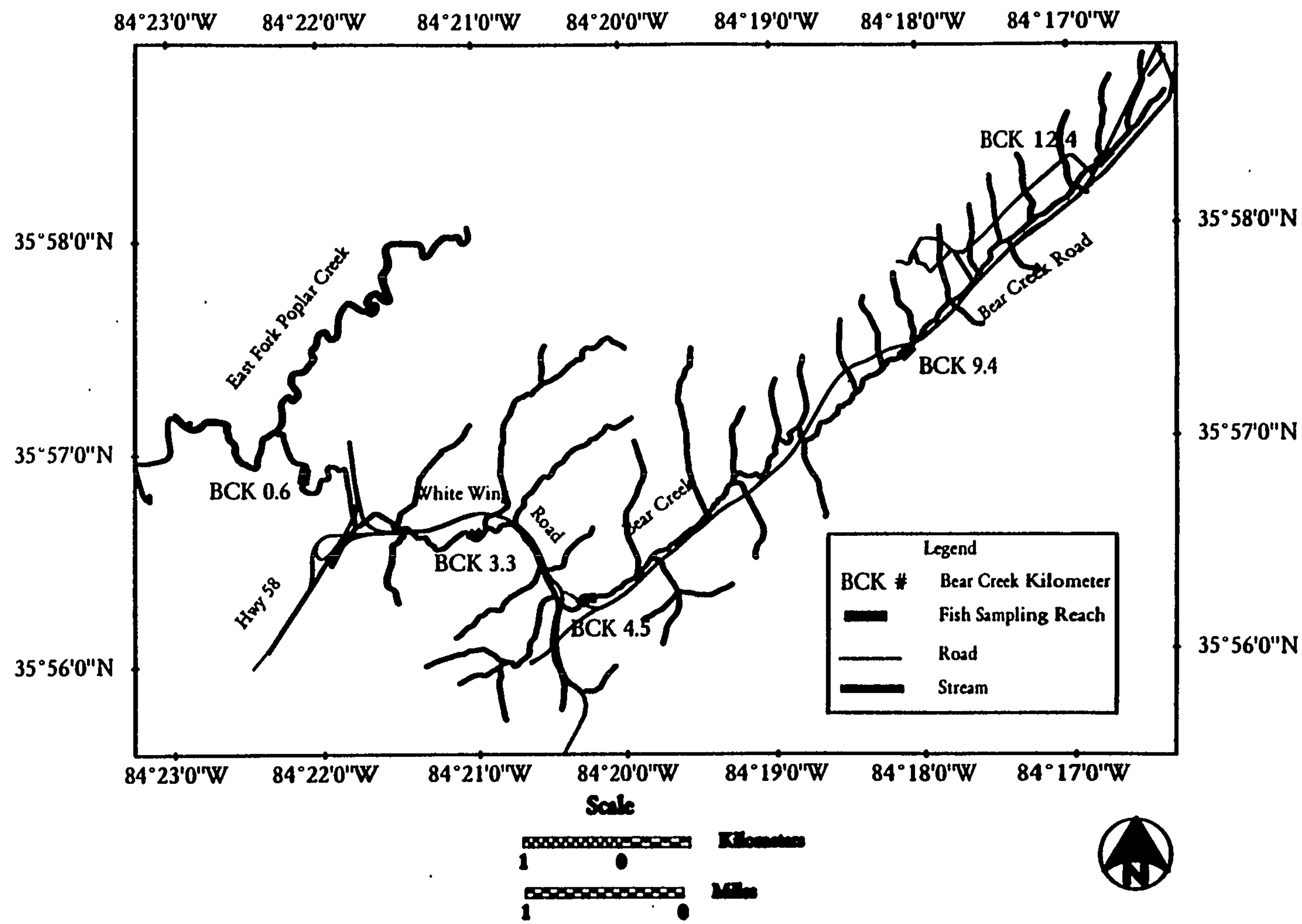



Fig. C.1. The Bear Creek fish sampling locations used in the ORR-wide ecological risk assessment. The map projection is Tennessee State Plane (TSP) meters, Zone 5301, and NAD 83. The study site location data is from BMAP and OREIS spatial database. The map was prepared by R.A. Washington-Allen, Environmental Sciences Division (ESD) ORNL on July 27, 1995.

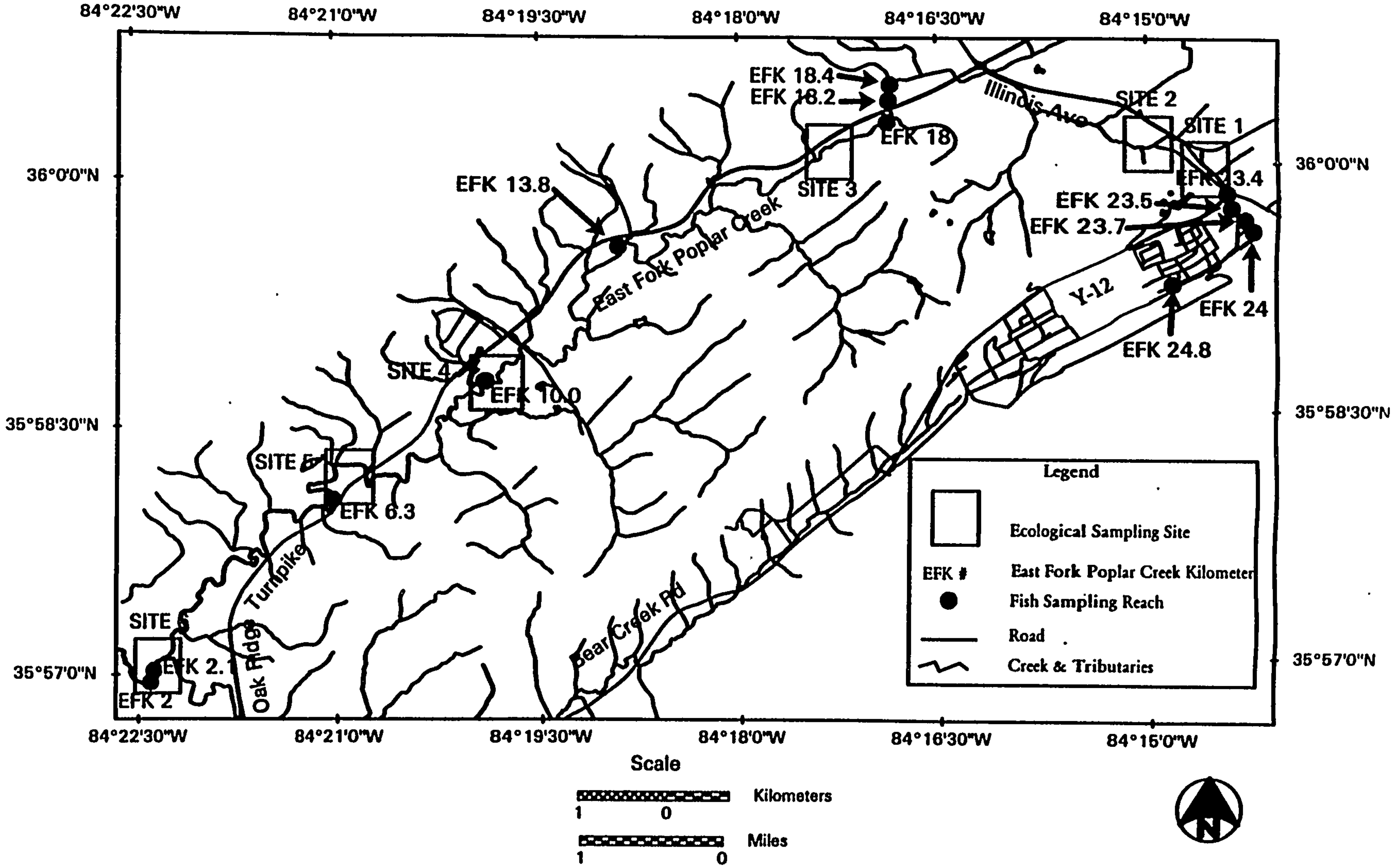



**Fig. C.2.** **The East Fork Poplar Creek fish and ecological sampling locations (from EFPC RI) used in the ORR-wide ecological risk assessment.** The map projection is Tennessee State Plane (TSP) meters, Zone 5301, and NAD 83. The study site location data is from SAIC, BMAP and OREIS spatial database. The map was prepared by R.A. Washington-Allen, Environmental Sciences Division (ESD) ORNL on July 27, 1995.

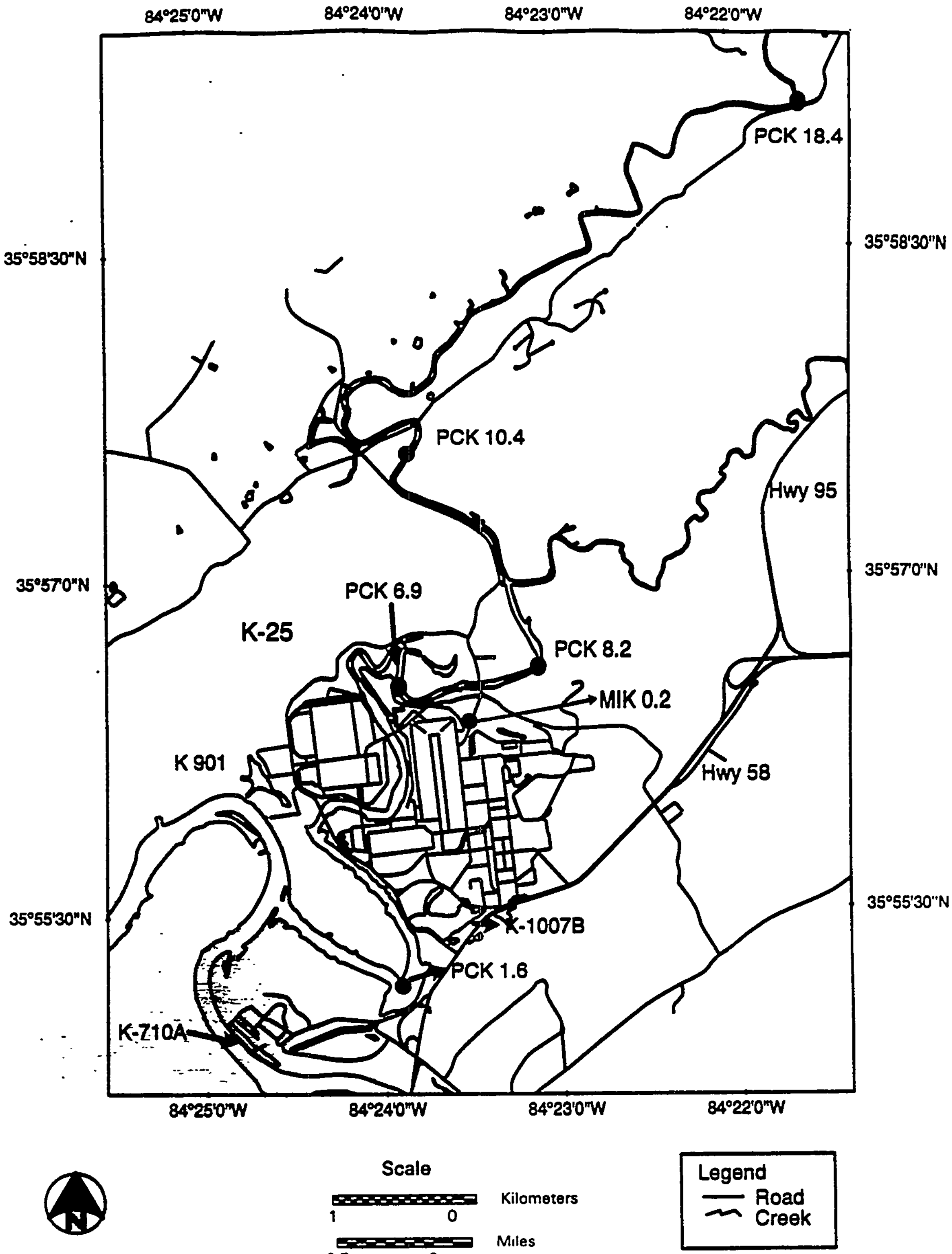



**Fig. C.3. The Poplar Creek sampling locations and ponds used to evaluate risks in the K-25 vicinity for the ORR-wide ecological risk assessment.** The map projection is Tennessee State Plane (TSP) meters, Zone 5301, and NAD 83. The study site location data is from BMAP and OREIS spatial database. The map was prepared by R.A. Washington-Allen, Environmental Sciences Division (ESD) ORNL on July 27, 1995.

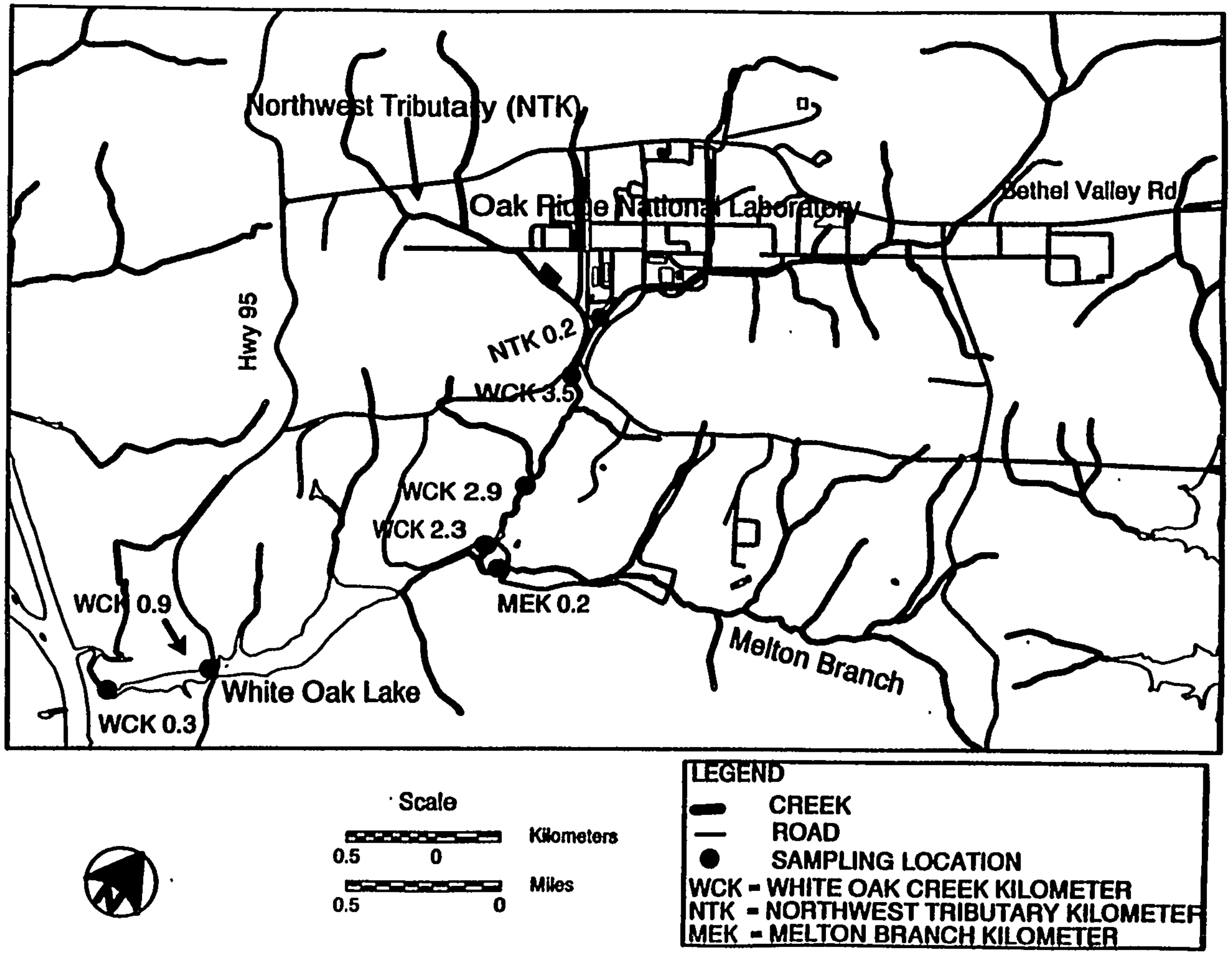



**Fig. C.4. The White Oak Creek fish sampling locations used in the ORR-wide ecological risk assessment.** The map projection is Tennessee State Plane (TSP) meters, Zone 5301, and NAD 83. The study site location data is from BMAP and OREIS spatial database. The map was prepared by R.A. Washington-Allen, Environmental Sciences Division (ESD) ORNL on July 27, 1995.

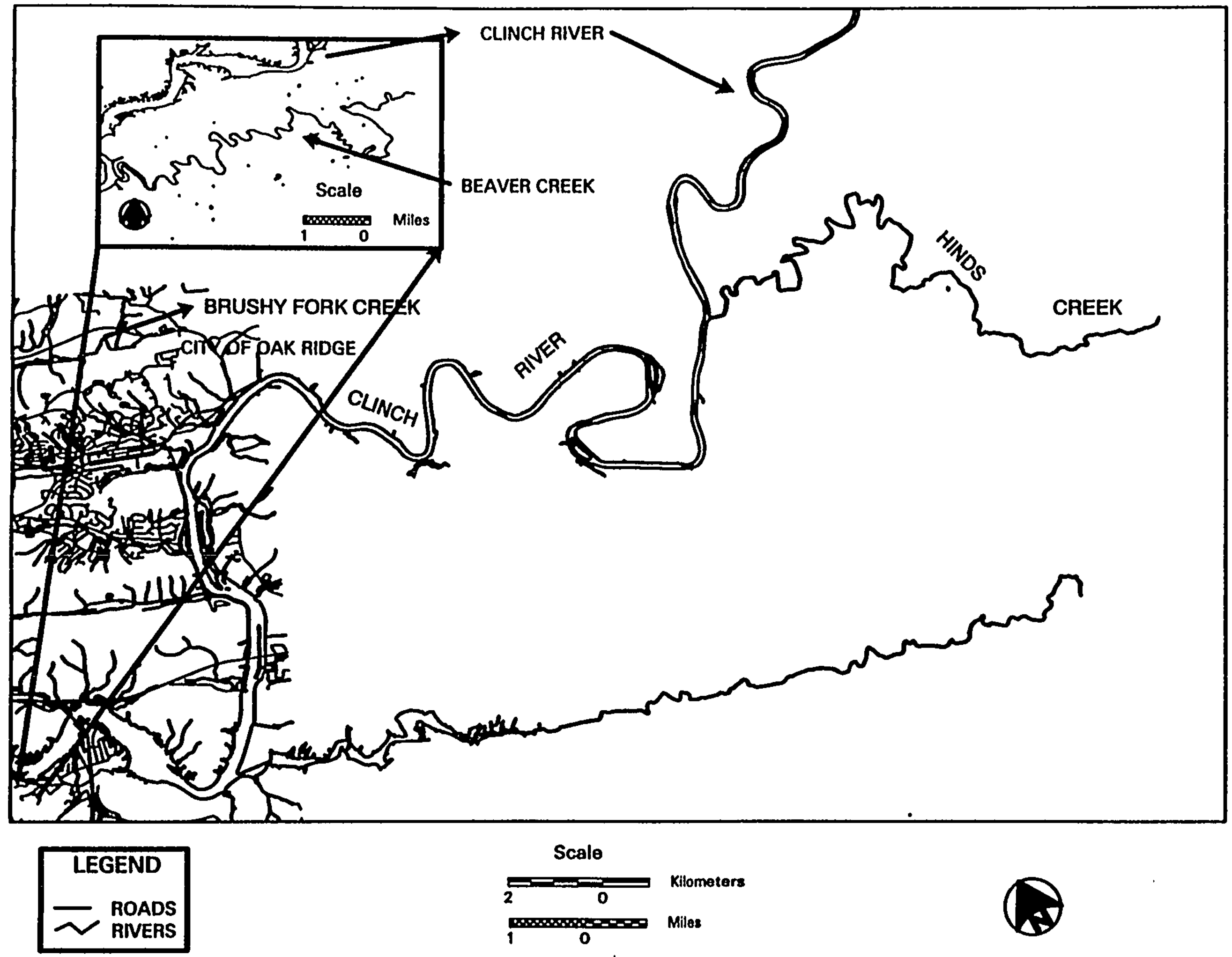



**Fig. C.5. The reference streams used in the ORR-wide ecological risk assessment.** The map projection is Tennessee State Plane (TSP) meters, Zone 5301, and NAD 83. The location data is from BMAP and OREIS spatial databases. The map was prepared by R.A. Washington-Allen, Environmental Sciences Division (ESD) ORNL on July 27, 1995.

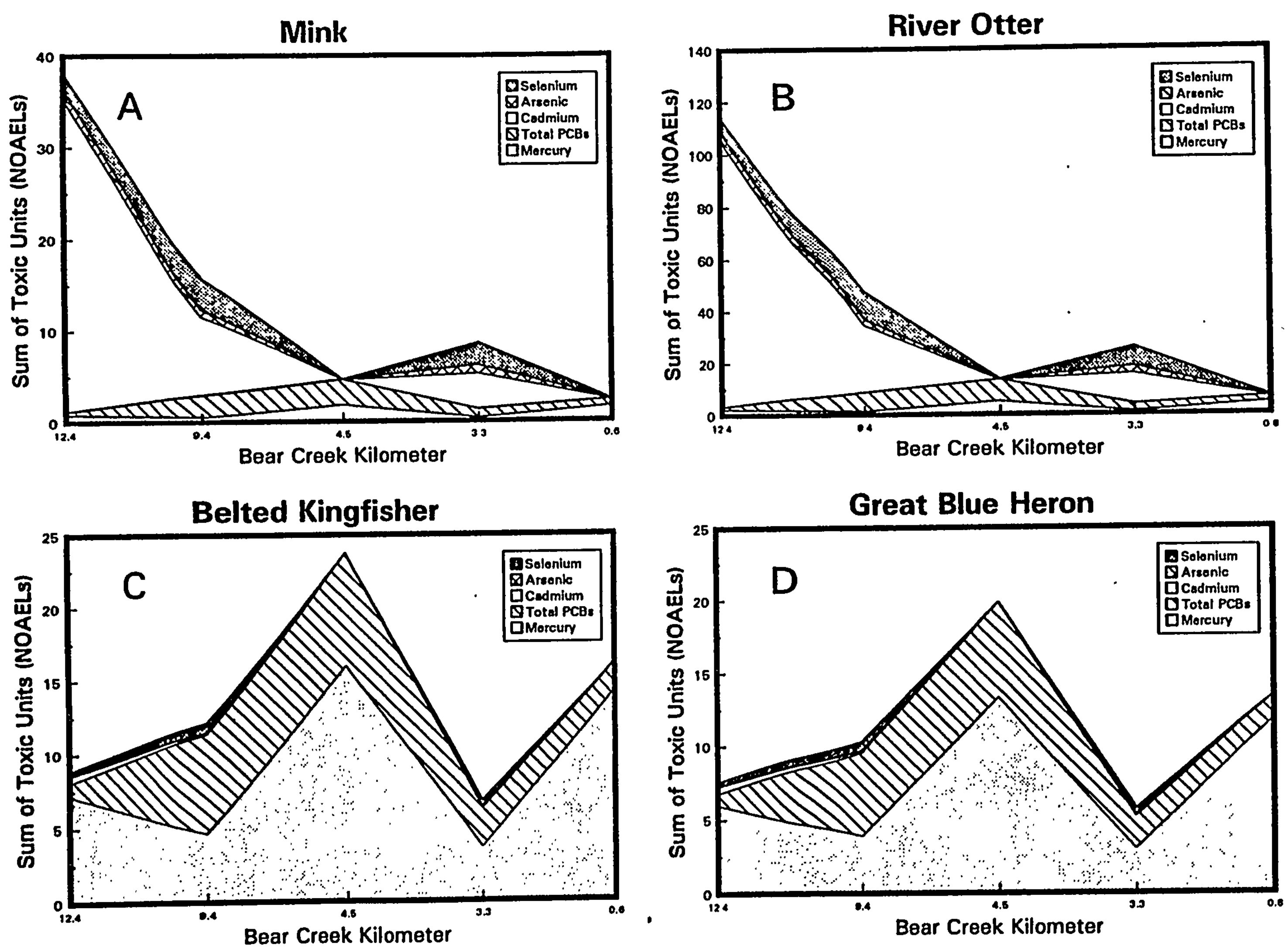



**Fig. C.6. Sum of NOAEL-based toxic units for evaluation of risks to piscivores in the Bear Creek Watershed.**

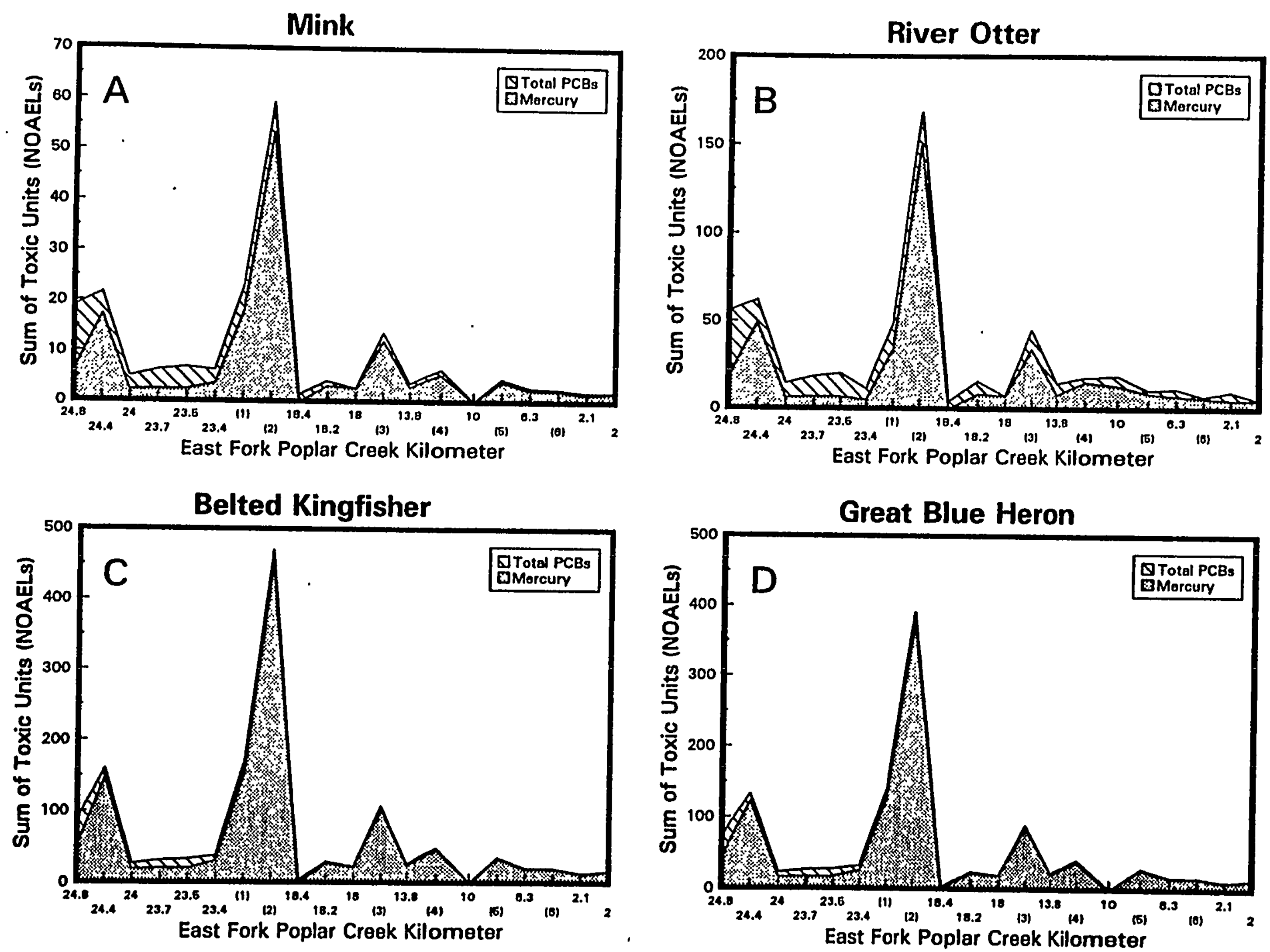



**Fig. C.7. Sum of NOAEL-based toxic units for evaluation of risks to piscivores in the East Fork Poplar Creek Watershed.** Locations in parentheses represent EFPC RI sampling locations.

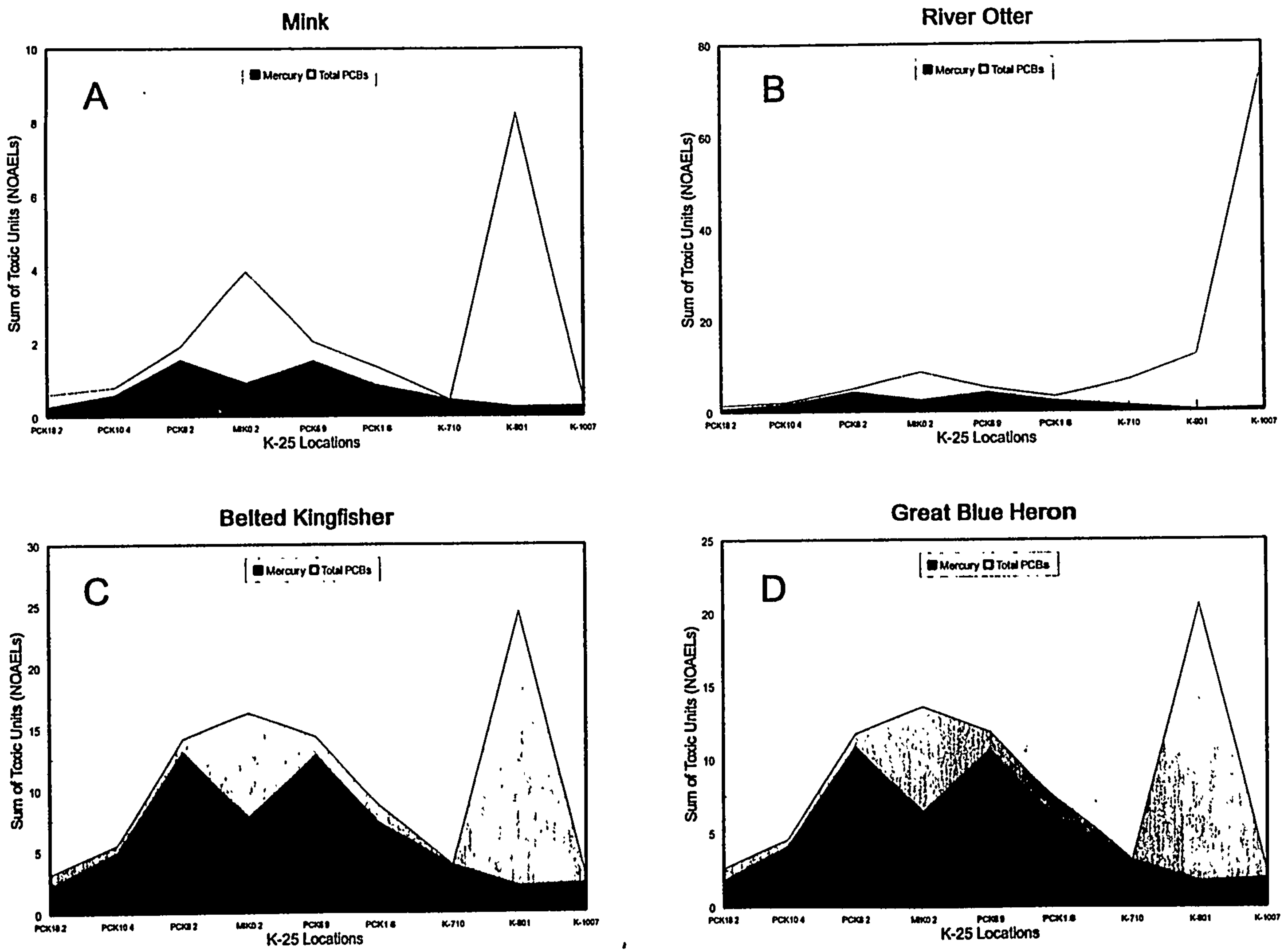



**Fig. C.8. Sum of NOAEL-based toxic units for evaluation of risks to piscivores in the K-25 vicinity. MIK = Mitchell Branch kilometer. K-710,** K-901, and K-1007 represent ponds in K-25 area

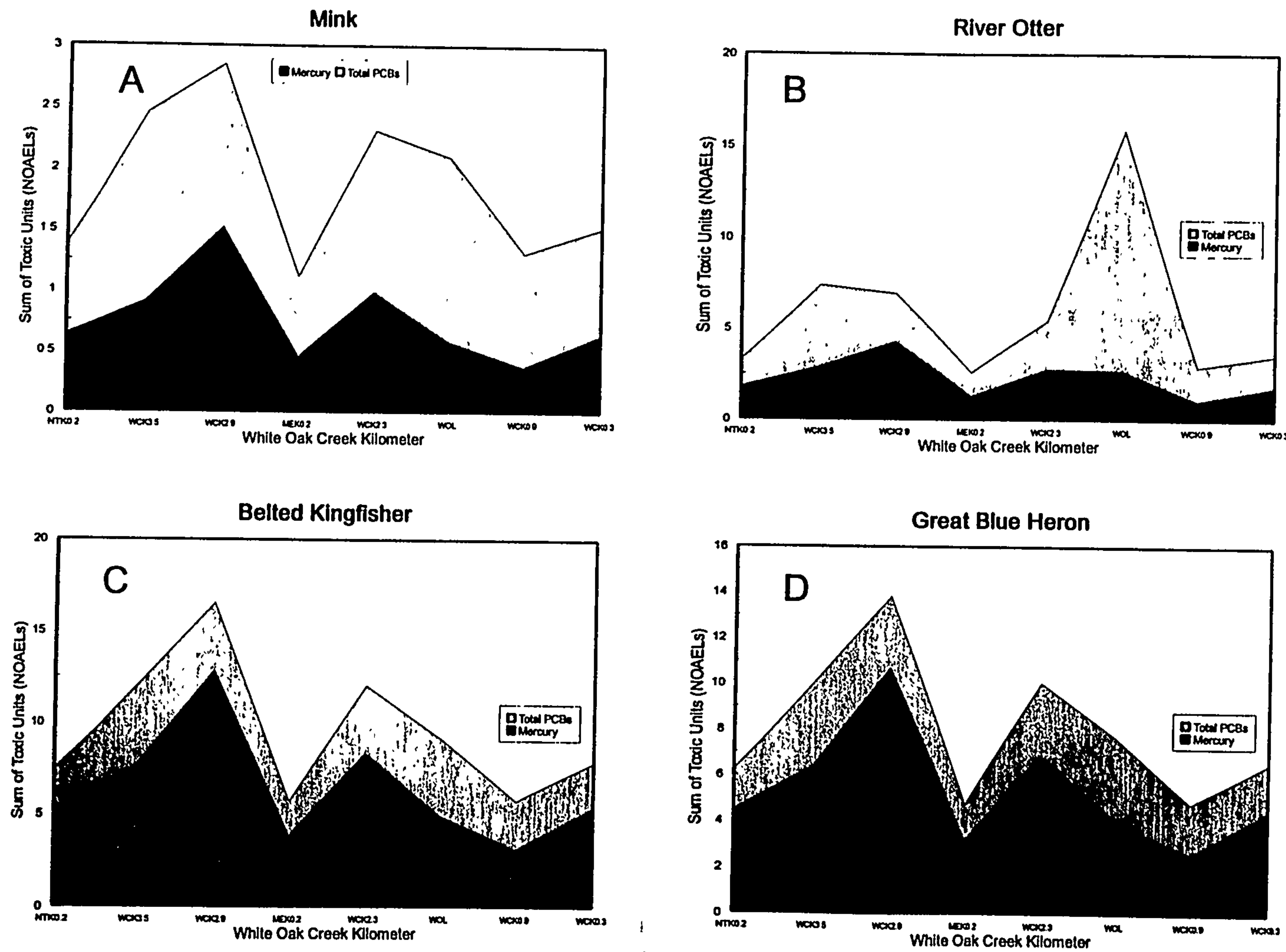



**Fig. C.9. Sum of NOAEL-based toxic units for evaluation of risks to piscivores in the White Oak Creek Watershed.** NTK = Northwest Tributary kilometer; MEK = Melton Branch kilometer; and WOL = White Oak Lake.

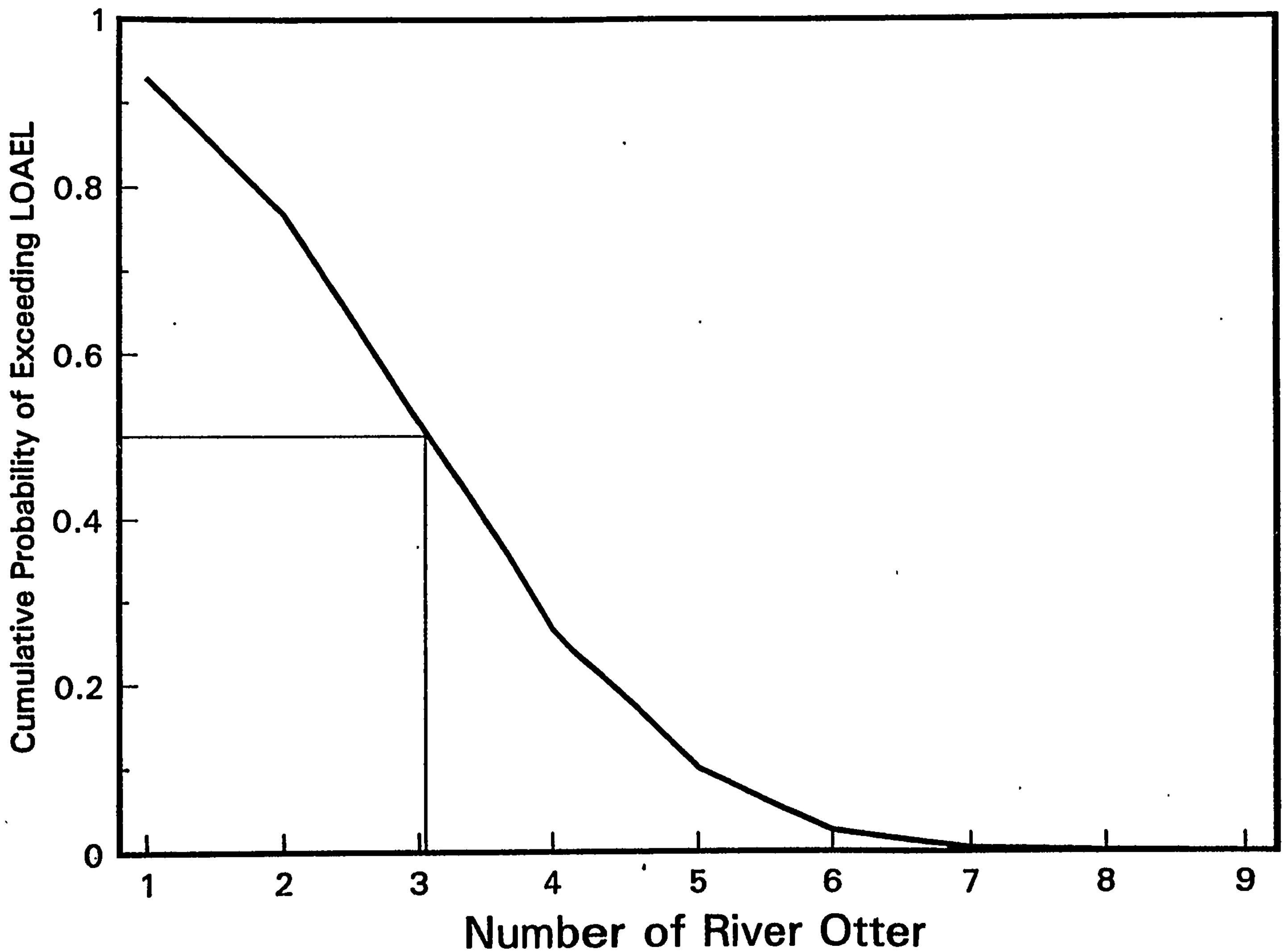



**Fig. C.10. Cumulative binomial probability of river otter experiencing exposure to mercury in East Fork Poplar Creek in excess of the LOAEL.** Data do not include EFPC RI observations.

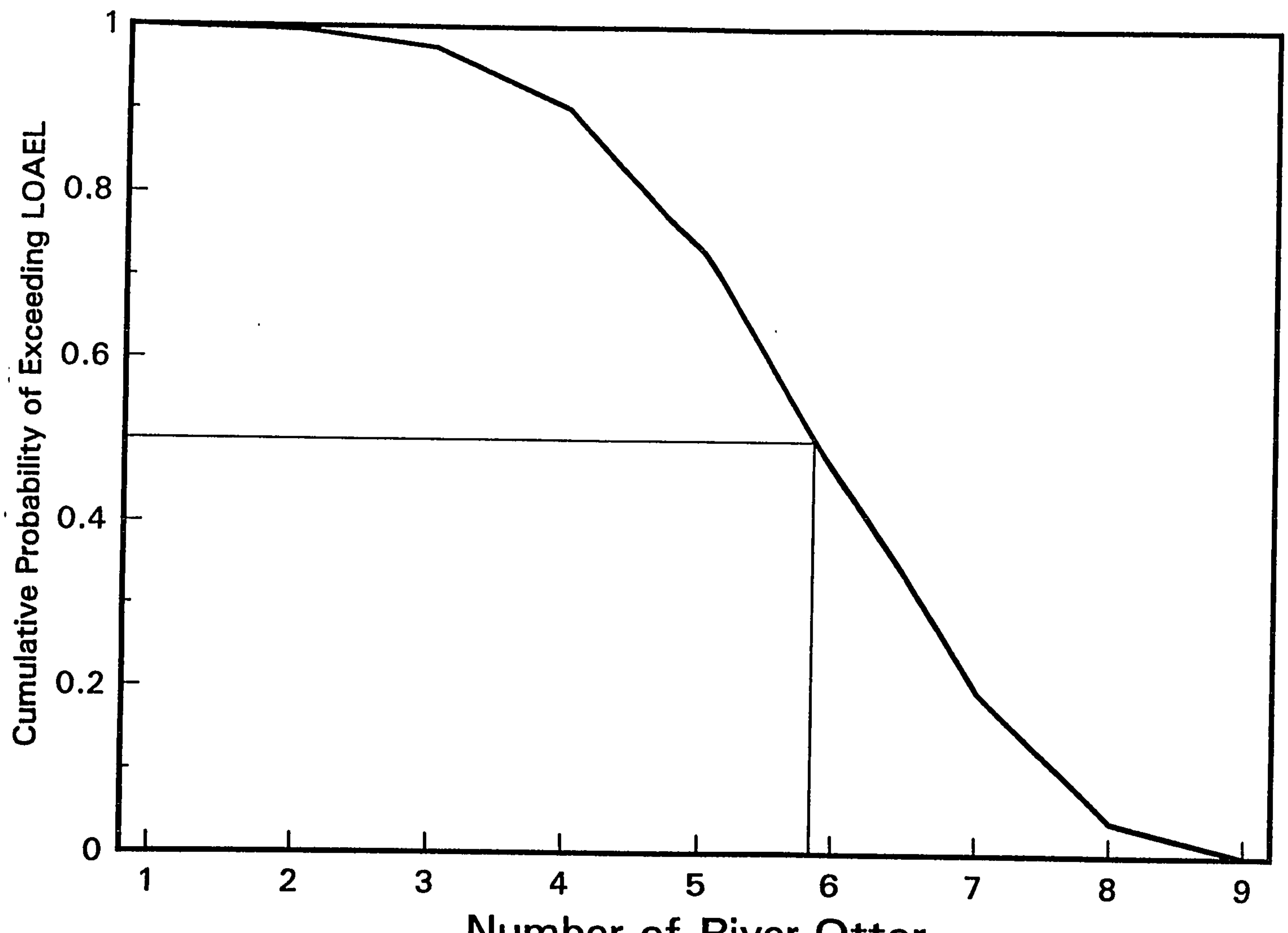



Fig. C.11. Cumulative binomial probability of river otter experiencing exposure to PCBs in the K-25 vicinity in excess of the LOAEL.

# Appendix D

# TOXICOLOGICAL PROFILES

**Aluminum.** Aluminum is an ubiquitous metal, being the third most abundant element in the earth's crust (Krueger et al., 1984). Relative to other metals, the toxicity of aluminum is low (Sorensen et al., 1974). The oral $LD_{50}$ for mice ranges from 770 to 980 mg aluminum/kg body weight (Ondreicka et al., 1966). The principal effect of aluminum is to interfere with phosphorous metabolism; in the alimentary canal, aluminum forms insoluble compounds with phosphorous resulting in an imbalance of calcium and phosphorous (Carrerie et al., 1986). Other effects of aluminum include neurotoxicity. Rats exposed to aluminum display behavioral abnormalities and have reduced acetylcholinesterase activity (Krueger et al., 1984). Mice consuming diets containing 500 to 1000 ppm aluminum displayed ataxia and paralysis of the hind limbs (Golub et al., 1987). In humans, aluminum has been associated with several degenerative diseases of the nervous system, including Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis (Ganrot, 1986).

Ondreicka et al. (1966) evaluated the effects of aluminum on mammalian reproduction. Mice received 19.3 mg aluminum/kg bodyweight/day (as $AlCl_3$) in drinking water for three generations. While the number of litters and offspring per litter was not reduced, growth was significantly reduced among all offspring in the second and third generations. In a similar study, rats received daily intragastric doses of 0, 180, 360, or 720 mg aluminum/kg body weight/day (Domingo et al., 1987) for one generation. Growth and survival of young was reduced among the groups that received 360 and 720 mg aluminum/kg/day. Other studies also report that while aluminum does not appear to affect the number of litters or number of offspring/litter, growth and survival of offspring of aluminum exposed parents is reduced (Golub et al., 1987; Paternain et al. 1988).

Due to it's interference with phosphorous and calcium metabolism, it has been suggested that aluminum may impair eggshell formation by birds, resulting in eggshell thinning (Nyholm, 1981). To test this hypothesis, Carriere et al. (1986) fed breeding ring doves (*Streptopelia risoria*) a diet containing 1000 ppm aluminum (and adequate but reduced calcium and phosphorous) and observed reproduction. While no reproductive effects or embryonic malformations were observed at this dosage level, significant reproductive effects resulted when birds were fed a diet deficient in calcium and phosphorous that contained 750 ppm aluminum. Therefore, among birds it appears that the manifestation of toxic effects of aluminum are dependent upon the nutritional quality of their diet.

**Arsenic.** Arsenic is present in the earth's crust at approximately 2 ppm, but tissues of animals generally contain an average of <0.5 ppm (Venugopal and Luckey, 1978). Arsenic may be a required micronutrient; growth, survival, and reproduction of goats is poor if the diet contains <0.05 ppm As (NAS, 1977).

Arsenic is a carcinogen and teratogen. Other effects include reduced growth, hearing/sight loss, liver/kidney damage, and death (Eisler, 1988a). Inorganic arsenic is usually more toxic than organic arsenic compounds. Wildlife mortality and malformations have been observed for chronic doses of 1-10 mg As/kg bw and dietary concentrations of 5-50 ppm (Eisler, 1988a). Acute $LD_{50}$s for mammals of 35–100 mg calcium arsenate/kg body weight and 10-50 mg lead arsenate/kg body weight have been reported (NRCC, 1978).

Schroeder and Mitchner (1971) exposed mice to 5 ppm sodium arsenite in drinking water for three generations. While mice fed arsenic survived well, litter size decreased in subsequent generations. A dose of 0.38 mg arsenic/kg over a lifetime was sufficient to cause a slight decrease in the median lifespan of laboratory mice (Schroeder and Balassa, 1967), but it had no effect on growth. As little as 3 mg arsenic trioxide/kg body weight or 1 mg sodium arsenite/kg body weight can be lethal (NAS, 1977).

Because metabolism of arsenic in rats is unlike that in other animals, results of toxicity studies using rats generally should not be extrapolated to other species (Eisler, 1988a).

Among birds, $LD_{50}$s for arsenic compounds range from 17.4 to 3300 mg/kg bw (Eisler, 1988a). While no mortality was observed among mallard ducks fed a diet containing 100 ppm sodium arsenite for 128 days, 12% to 92% mortality was observed for ducks fed diets containing 250 to 1000 ppm arsenite (USFWS, 1964). Camardese et al. (1990) and Whitworth et al. (1991) fed mallards diets containing 30, 100, or 300 ppm sodium arsenate. While no effects were observed on behavior, growth was reduced for male ducks consuming 300 ppm arsenic and for female ducks at all exposure levels.

**Barium.** The soluble salts of barium, an alkaline earth metal, are toxic in mammalian systems. At low doses, barium acts as a muscle stimulant and at higher doses affects the nervous system eventually leading to paralysis. The $LD_{50}$ for rats is listed as 630 mg/kg for barium carbonate, 118 mg/kg for barium chloride, and 921 mg/kg for barium acetate (Lewis and Sweet, 1984).

Schroeder and Mitchener (1975a, b) exposed rats and mice to 5 mg barium/L in drinking water for their lifetime. There was a slight but significant reduction in longevity of treated male mice when measured as the mean age at death of the last surviving 10% of animals. The overall average life span of the group, however, was about the same as the control group. In another study, Perry et al. (1983) exposed rats to 0, 1, 10, or 100 ppm barium for up to 16 months. A significant increase in average blood pressure was observed in the highest dose group; a slight but statistically significant increase was seen in the 10 ppm dose group. Information on developmental and reproductive toxicity of barium to mammals is not available.

The $LD_{50}$ of barium to chickens is 623 mg/kg (Johnson et al., 1960). Johnson et al. (1960) report that while chickens will tolerate 1000 ppm barium in their diet without adverse effects, 2000 ppm reduces growth, 8000 ppm produces 50% mortality in 4 weeks, and diets containing 16,000 or 32,000 ppm barium are 100% lethal.

**Cadmium.** While there is little information to indicate that this relatively rare metal is biologically essential or beneficial, Cd has been suggested as the cause of various deleterious effects to wildlife (Eisler 1985a). Mammals and birds are comparatively resistant to the biocidal properties of Cd, which include growth retardation, anemia, and testicular damage. Cd tends to bioaccumulation the liver and kidney, eventually acting as a cumulative toxin. Cd residues of 2 ppm whole body fresh weight are evidence of Cd contamination, and residues >5 ppm whole animal fresh weight may be life-threatening (Eisler 1985a).

The lowest oral dose resulting in death for rats was 250 mg Cd/kg body weight (EPA 1980a). Weigel et al. (1987) fed rats 0.24, 0.85, or 2.25 mg/kg Cd in diet for 8 weeks. Concentrations

≥0.85 mg/kg resulted in reduced food intake, reduced body weights, and reduced enzyme activity, but no hematological effects were noted. Ma et al. (1991) determined that an average cadmium intake of 15 mg/kg/day corresponded with critical renal metal loads of 120 mg/kg, a level indicative of adverse health effects. Rats on a diet with 5 ppm Cd suffered shortened lifespans (Schroeder et al. 1965). Cd at 50 ppm in the diet depleted iron from rat livers (Whanger 1973). Rats eating diets with 7.15 ppm Cd (as CdO) exhibited growth reductions, but those consuming a diet with 2.80 ppm Cd did not (Weigel et al. 1984). In a 3 generation reproductive study, the population of mice exposed to 1 ppm $CdCl_2$ in their drinking water died out after the second generation (Schroeder and Mitchner 1971). Rats receiving >6 mg Cd/kg body weight daily during pregnancy gave birth to malformed fetuses (Ferm and Layton 1981).

No mortality was observed among adult mallard ducks fed diets containing 0, 2, 20, and 200 ppm Cd, however egg production was significantly reduced in the group consuming 200 ppm Cd (White and Finley 1978). In addition, the testes of males in the 200 ppm Cd group atrophied and the spermatogenic process was disrupted (White et al. 1978). Among mallard ducklings, 20 ppm Cd in the diet produces mild to severe kidney lesions, reduces packed cell volume and hemoglobin concentrations in the blood (Cain et al. 1983). Avoidance behavior of black ducklings is impaired by diets containing 40 ppm Cd (Heinz and Haseltine 1983).

**Copper.** Copper occurs naturally in elemental form and as a component of many minerals. It is an essential nutrient that is normally present in a wide variety of tissues (ATSDR, 1990; EPA, 1987c). Because of its high electrical and thermal conductivity, it is widely used in the manufacture of electrical equipment. Common copper salts, such as the sulfate, carbonate, cyanide, oxide, and sulfide are used as fungicides, as components of ceramics and pyrotechnics, for electroplating, and for numerous other industrial applications (ACGIH, 1986). The largest anthropogenic releases of copper to the environment result from mining operations, agriculture, solid waste, and sludge from sewage treatment plants. Natural discharges to air and water, such as windblown dust and volcanic eruptions, may be significant (ATSDR, 1990).

Copper is a component of a number of metalloenzymes such as catalase, peroxidases, and cytochrome oxidase and is essential for the utilization of iron (Goyer, 1991; Stokinger, 1981). Although most copper salts occur in two valence states, as cuprous ($Cu^+$) or cupric ($Cu^{2+}$) ions, the biological availability and toxicity of copper is most likely associated with the divalent state (ATSDR, 1990). Copper sulfate is the most common copper salt. Copper is soluble in nitric acid and hot sulfuric acid, very slightly soluble in hydrochloric acid and ammonia, and insoluble in water (Stokinger, 1981).

The metabolism of copper involves mainly its transfer to and from various organic ligands, most notably sulfhydryl and imidazole groups on amino acids and proteins (ATSDR, 1990). The liver is one of the main organs involved in the storage and metabolism of copper. Absorption of ingested copper occurs primarily in the upper gastrointestinal tract (EPA, 1987c). Soluble copper compounds (oxides, hydroxides, citrates) are readily absorbed but water-insoluble compounds (sulfides) are poorly absorbed (Venugopal and Luckey, 1978). Zinc, molybdenum, and other metals may decrease dietary copper absorption (USAF, 1990).

In animal studies, oral exposure to copper caused hepatic and renal accumulation of copper, liver and kidney necrosis at doses of ≥100 mg/kg/day, and hematological effects at doses of 40 mg/kg/day (EPA, 1986; Haywood, 1985; Rana and Kumar, 1978; Gopinath et al., 1974; Kline et al., 1971). Oral or intravenous administration of copper sulfate can increase fetal mortality and developmental abnormalities in experimental animals (Lecyk, 1980; Ferm and Hanlon, 1974). Rat oral $LD_{50}$ values for various copper compounds are 140 mg/kg for copper chloride ($CuCl_2$); 470 mg/kg for copper oxide ($Cu_2O$); 940 mg/kg for copper nitrate ($Cu(NO_3)_2 \cdot 3H_2O$); and 960 mg/kg for copper sulfate ($CuSO_4 \cdot 5\ H_2O$) (Stokinger, 1981). Deaths in animals given lethal doses of copper have been attributed to extensive hepatic centrilobular necrosis (USAF 1990).

In a 90-day subchronic study with copper cyanide (CuCN), high mortality, attributed to hemolytic anemia, was seen in both male and female rats receiving 50 mg/kg/day by gavage, but not in those receiving ≤ 5 mg/kg/day (EPA 1986c). In general, male rats appeared to be more sensitive to the effects of CuCN than female rats. Rats receiving 500 ppm copper in their diet (about 5 mg/day) appeared normal, while rats receiving 1000 ppm exhibited depressed growth, those at 2000 ppm hardly grew at all, and those on a 4000 ppm diet lost weight rapidly and died (Boyden et al. 1938). Salt licks containing 5–9% copper sulfate caused anorexia, hemolytic anemia, icterus, and hemoglobinuria, followed by death within 2 days in sheep using the licks (Gopinath et al. 1974). The estimated ingested dose was 40–49 g over a 25- to 86-day period. Lecyk (1980) observed reduced litter size, decreased fetal weights, and skeletal abnormalities in the offspring of mice fed diets supplemented with 3000 or 4000 ppm copper sulfate (155 or 207 mg copper/kg/day, respectively) for one month prior to gestation and on days 0–19 of gestation.

Aulerich et al. (1982) reported an increased mortality rate in the offspring of minks fed a diet supplemented with >3 mg copper/kg/day as copper sulfate for 50 weeks. Although kit mortality was greater and litter mass was reduced relative to controls, reproductive performance of mink fed diets supplemented with up to 200 ppm copper for 357 days was within the normal range for the species (Aulerich et al., 1982). Lifetime exposure to 42.4 mg copper/kg/day (as copper gluconate) in drinking water caused a 12.8% decrease in the maximal lifespan in mice (Massie and Aiello, 1984).

Domestic chicks on diets ≥324 ppm copper grew slowly; mortality increased with dietary copper concentrations of 1270 ppm (Mayo et al. 1956). Arthur et al. (1958) observed no ill effects in chicks fed ≤500 ppm copper in diet up to 8 weeks of age. Dietary copper levels from 588–1176 ppm for 10 weeks exerted a toxic effect on chick growth; the minimum toxic level of copper appeared to be about 500 ppm (Mehring et al., 1960). Turkey poults tolerated 676 ppm copper in starter diets for 21 days with no deleterious effects, but copper was definitely toxic at levels >1620 ppm (Vohra and Kratzer, 1968). Chickens given a daily dose of >70 mg/kg of $CuCO_3$ died while those receiving <60 mg/kg exhibited slight symptoms of copper poisoning but survived (Pullar, 1940). No symptoms of copper poisoning were observed in domestic mallards ingesting ≤29 mg/kg/day of $CuCO_3$, but daily intakes ≥55 mg/kg/day were toxic (Pullar, 1940).

**Lead.** Lead is a comparatively rare metal, averaging 16 ppm in the earth's crust, that is neither essential nor beneficial in living organisms (Eisler, 1988b). Lead has adverse effects on survival, growth, reproduction, development, behavior, learning, and metabolism. In general, organic lead compounds are more toxic than inorganic compounds, biomagnification of lead is minimal, and younger organisms are more susceptible to lead toxicity (Eisler, 1988b).

Acute oral doses of 5–108 mg lead/kg bw reduced rat survival (Eisler, 1988b), and rats fed diets with 5 ppm lead had shortened life spans (Schroeder et al., 1965). An acute $LD_{50}$ based on a single oral dose of 12 mg tetraethyllead/kg body weight was reported by Branica and Konrad (1980). Rats fed 0.5, 5, 25, or 250 ppm inorganic lead in diets over two generations exhibited no substantial developmental effects (Kimmel et al., 1980). In another study, Azar et al. (1973) fed rats a diet containing 0, 10, 50, 100, 1000, or 2000 ppm lead acetate for three generations. While the number of litters and young/litter was not affected by any dose level, growth was reduced and kidney histopathologies were observed among offspring in the 1000 and 2000 ppm treatments. Frequency of pregnancy was reduced in mice ingesting 3 mg/kg body weight tetraethyllead daily, and daily ingestion of 1.5 mg/kg tetraethyllead chloride resulted in a reduction in the success of implanted ova (Clark, 1979).

Anemia and other hematological effects were induced among pigeons orally dosed with 6.25 mg lead/kg bw/day (Anders et al., 1982). Kendall and Scanlon (1981) exposed ring doves to drinking water containing 0 or 100 ppm lead and observed no effects on time to produce eggs, egg production, or fertility. However, testes weight and sperm count was decreased among lead-exposed males. Grandjean (1976) correlated eggshell thickness and eggshell lead levels in European kestrels (*Falco tinnunculus*), suggesting that lead may cause eggshell thinning. Among American kestrels (*Falco sparvarius*) fed diets containing 0, 10, or 50 ppm lead, no adverse effects survival, egg-laying, initiation of incubation, egg fertility, or eggshell thickness were observed (Pattee, 1984).

**Mercury.** Mercury has no known biological function and is potentially toxic to fish and wildlife. Mercury is a mutagen, teratogen, and carcinogen that adversely affects the central nervous, renal, and reproductive systems of wildlife (Eisler, 1987). Inorganic mercury compounds in aquatic systems are readily converted to organomercury by microbial action (Berlin, 1979), with organomercury compounds being more toxic than inorganic mercury compounds. Biota bioconcentrate mercury compounds which can be further biomagnified through food chains (Wren, 1986).

Daily doses of 0.1–0.5 mg/kg bw/day and dietary concentrations of 1.0–5.0 ppm are lethal to sensitive mammals (Eisler, 1987). Central nervous system toxicity, weight loss, and mortality were observed among rats fed a diet containing 250 ppm methyl mercury (MeHg) for 2 weeks (Verschuuren et al., 1976a). Rats consuming 2.5 ppm MeHg in the diet for 2 years displayed reduced growth, increased kidney weight, and altered kidney histochemistry (Verschuuren et al., 1976b). To study effects on reproduction, Verschuuren et al. (1976c) fed rats a diet containing 0, 0.1, 0.5, and 2.5 ppm MeHg for three generations. While no effects were observed among rats fed 0.1 or 0.5 ppm MeHg, offspring viability was reduced among rats in the 2.5 ppm treatment. Among mink, 93-day consumption of diets containing 1.8 to 15.0 ppm MeHg produced mortality, ataxia, anorexia, and paralysis (Wobeser et al., 1976), with the highest exposures showing the greatest effects.

The $LD_{50}$ for MeHg for *Coturnix* quail ranges from 14.4 to 33.7 mg/kg bw (Eisler, 1987). Growth was decreased and mortality increased among leghorn cockerels fed diets containing 6 to 18 ppm MeHg (Fimreite, 1970). Ring-necked pheasants fed diets of MeHg-treated grains displayed reduced egg production and hatchability and laid more shell-less eggs than controls (Fimreite, 1971). Heinz (1979) fed mallard ducks a diet containing 0.5 ppm MeHg for three generations. While MeHg consumption did not affect adult weights or weight change during the reproductive season, MeHg-exposed females laid fewer eggs (with more eggs outside the nest box), produced fewer young, and displayed slightly thinner eggshells. Young of MeHg-treated adults were less responsive to maternal calls and hyper-responsive to fright stimuli.

**PCBs:** Polychlorinated biphenyls (PCBs) are a family of man-made chemicals consisting of 209 individual compounds with varying toxicity (ATSDR 1989). Aroclor is the trade name for PCBs made by Monsanto. Because of their insulating and nonflammable properties, PCBs were widely used in industrial applications such as coolants and lubricants in transformers, capacitors, and electrical equipment (ATSDR 1989). The United States stopped manufacturing PCBs in 1977 due to evidence that they accumulate in the environment. PCBs have become widespread environmental contaminants.

Most exposures to PCBs are oral. Absorption of PCBs following oral exposure is often >90% (ATSDR 1989). PCBs are preferentially stored in adipose tissues in animals. They may cross the placenta or be transferred to offspring through milk. PCBs with higher chlorine content (the last 2 digits of the Aroclor designation indicate the percent Cl content of the compound) tend to persist in the environment longer than those with lower Cl content, and PCBs are known to bioaccumulate and biomagnify to toxic concentrations in animals (Eisler 1986, ATSDR 1989). Chronic exposures are of particular concern. PCBs with high $K_{ow}$ values and high numbers of chlorines in adjacent positions are generally the most toxic. Although relatively insoluble in water, PCBs are generally freely soluble in nonpolar organic solvents and in biological lipids (U.S. EPA 1980).

Sixty percent of mice fed diets containing 1,000 ppm Aroclor 1254 for 14 days died within 15 days, but none of the mice fed diets with only 250 ppm Aroclor for 14 days died (Sanders et al. 1974). These diets translate to doses of 130 and 32.5 mg/kg/day, respectively (ATSDR 1989). White-footed mice fed 10 ppm Aroclor 1254 for 18 months had fewer offspring produced and a longer time between litters than control mice (Linzey, 1987).

Feeding studies suggest a total intake of 500-2,000 mg/kg of Aroclor 1254 obtained through the diet over 1 to 7 weeks is lethal in rats (Hudson et al. 1984). Male rats consuming diets containing 0-100 ppm Aroclor 1254 for 104 weeks suffered dose-related reduced survival (NCI 1978); however, there was no effect on similarly treated female rats. Dietary concentrations of ≥20 ppm Aroclor 1254 reduced litter sizes in one- and two-generation reproduction studies with rats; concentrations <5 ppm had no effect (Linder et al. 1974).

Mink are one of the most susceptible mammals; dietary levels as low as 0.1 ppm fresh weight have caused death and reproductive toxicity (Eisler 1986). Diets containing 20 ppm Aroclor 1242 were lethal to mink in a 247-day experiment. The $LC_{50}$ for chronic exposures is 6.65 ppm Aroclor 1254 for mink over a 8 month period (Ringer et al. 1981). Diets containing 5 ppm Aroclor 1242 caused complete reproductive failure (Bleavins et al., 1980). Exposure for 160 days to 3.57 ppm Aroclor 1254 resulted in 100% mortality of adult mink (Platonow and Karstad, 1973).

A chronic study was conducted over 4.5 months exposing mink to 1, 5 and 15 ppm Aroclor 1254 in the diet. There was a significant reduction in the number of offspring born alive at the 5 and 15 mg/kg exposures (Aulerich and Ringer 1977). Mink fed carp containing

1.5 ppm Aroclor 1254 for 6 months produced no offspring that survived to 24 hours (Hornshaw et al., 1983). No effects were observed in mink fed 0.64 ppm Aroclor 1254 for 160 days (Platonow and Karstad, 1973). Exposure of mink for 6 months to 1 ppm Aroclor 1254 resulted in no significant difference from controls in number of offspring, or offspring mortality (Wren et al., 1987). Therefore, the 1 ppm dose was considered to be a chronic NOAEL.

A dietary dose of 25 ppm Aroclor 1254 fed for at lease a month before egg-laying in mallard ducks had no detrimental effect on reproductive success (Custer and Heinz, 1980). Dietary exposure of 5 ppm Aroclor 1254 for 39 weeks to laying hens and roosters resulted in reduced egg production, although hatchability of fertile eggs was not affected (Platonow and Reinhart, 1973). Screech owls fed 3 ppm Aroclor 1248 through two breeding seasons did not have significantly different reproductive success, relative to controls (McLane and Hughes, 1980). Exposure of pheasants to 12.5 mg/bird/week (1.8 mg/kg/d) of Aroclor 1254 for 17 weeks resulted in significantly reduced egg hatchability (Dahlgren et al. 1972). Because this study considered exposure throughout a critical lifestage (reproduction), the 12.5 mg/bird/week dose was considered to be a chronic LOAEL.

**Selenium.** While selenium is an essential nutrient that interacts with Vitamin E and maintains muscle integrity, it has a very narrow tolerance range; in humans, while 0.04-0.1 ppm is required in diet, 4 ppm may produce toxic effects (Eisler, 1985b). In mammals, chronic selenium poisoning is induced by diets containing 1–44 ppm selenium (Harr, 1978). Symptoms include liver cirrhosis, lameness, loss of hair, emaciation, reduced conception, and increased fetal resorption. Plants convert inorganic selenium to organic selenium compounds, thereby increasing their biological availability (Lo and Sandi, 1980).

To evaluate the effects of selenium on reproduction, Schroeder and Mitchner (1971) exposed mice to 3 ppm selenate in drinking water for three generations. This dosage level increased juvenile mortality, number of runts, and resulted in reproductive failure by the third generation. In another study, exposure to 3 ppm selenate or selenite in water for a lifetime had no effect on mouse longevity and no tumorigenicity was observed (Schroeder and Mitchner, 1972).

Selenium is both embryotoxic and teratogenic to birds, with organic selenium (selenomethionine) being more toxic than inorganic selenium (Hoffman and Heinz, 1988). Mallard ducks were fed diets containing 1, 5, 10, 25, or 100 ppm selenite (Heinz et al., 1987) or 1, 2, 4, 8, or 16 ppm selenomethionine (Heinz et al., 1989) for about 10 weeks. Exposure to 1, 5, or 10 ppm selenite or 1, 2, or 4 ppm selenomethionine in the diet had no effect on survival, growth, or reproductive success of adults. The diet containing 100 ppm selenite killed 11 of 12 adults. While only one adult receiving the 25 ppm diet died, time to laying, interval between eggs was increased, and duckling survivorship was reduced in this treatment (Heinz et al., 1987). Diets containing 8 and 16 ppm selenomethionine resulted in 6.8% and 67.9% malformed embryos, respectively. In addition, duckling survival was significantly reduced (Heinz et al., 1989).

The most visible incident of environmental selenium toxicity occurred at the Kesterson National Wildlife Refuge in California. Agricultural wastewater containing approximately 0.3 ppm selenium was used for marsh management at the refuge (Ohlendorf et al., 1986). Mean selenium concentrations in plants, invertebrates, and fish at the site were 22–175 ppm (dry weight). As a result, reproductive success among water birds was poor, and the incidence of embryo mortality and developmental abnormalities was dramatically increased. Raccoons on the refuge were found to bioaccumulate selenium (Clark et al., 1989). While peak births at the refuge was 2 months later than reported at other locations, no adverse effects on raccoon reproduction were observed.

Metabolism of selenium may be significantly modified through interactions with heavy metals, and selenium may provide some protection from adverse effects associated with various metals, including cadmium and mercury (Eisler, 1985). Arsenite inhibits methylation of selenium but increases fecal excretion of selenite (Venugopal and Luckey, 1978).

**Thallium.** Thallium is a widely distributed metal, occurring at concentrations of approximately 1 ppm in the earths crust (Kazantzis 1979). Principal systems affected by Tl exposure include nervous and digestive; renal damage and hair loss have also been observed. Thallium sulfate, which has been widely used as a rodenticide, has an acute oral $LD_{50}$ of 16 mg/kg (Ware 1978). In chronic studies, rats tolerated a dose of 10 mg Tl acetate/ kg, while 30 mg/kg was lethal to males by 15 weeks. All rats fed a daily dose of 0.45 mg Tl/kg died after 4 months (Kazantzis 1979). Rats exposed to 10 ppm Tl in drinking water for 2 mo accumulated Tl in testis and exhibited signs of testicular toxicity including reduced sperm motility (Formigli et al. 1986).

Bean and Hudson (1976) orally dosed 3 golden eagles with 60 and 120 mg $Tl_2SO_4$/kg bw; the bird receiving 60 mg $Tl_2SO_4$/kg survived while the two dosed with 120 mg $Tl_2SO_4$/kg died, suggesting an $LD_{50}$ between the doses. Oral $LD_{50}$'s for quail, geese, and ducks are 12, 15, and 30 mg/kg respectively (Shaw 1933). No long-term studies of thallium toxicity to birds are currently available.

**Zinc.** Zinc makes up about 0.002% of the earth's crust (NAS 1980). Zinc is an essential trace element in all living organisms; it assures the stability of biological molecules and structures such as DNA, membranes, and ribosomes (Eisler, 1993). It is used commercially primarily in galvanized metals and metal alloys, but zinc compounds also have wide applications as chemical intermediates, catalysts, pigments, vulcanization activators and accelerators in the rubber industry, UV stabilizers, and supplements in animal feeds and fertilizers. Zinc compounds are also used in rayon manufacture, smoke bombs, soldering fluxes, mordants for printing and dyeing, wood preservatives, mildew inhibitors, deodorants, antiseptics, and astringents (Lloyd, 1984; ATSDR, 1989). In addition, zinc phosphide is used as a rodenticide.

Zinc occurs in nature as a sulfide, oxide, or carbonate (Eisler, 1993). It is divalent in solution. In freshwater with pH >4 and <7 it exists almost exclusively as the aquo ion $(Zn(H_2O)_6)^{2+}$ (Campbell and Stokes, 1985). Zinc interacts with many chemicals, and it may diminish the toxic effects of cadmium and protects against lead toxicosis in terrestrial animals (Eisler, 1993). Background concentrations seldom exceed 0.040 mg/L in water or 200 mg/kg in soil or sediment (Eisler, 1993).

Although it is essential for normal growth and reproduction (Prasad, 1979; Stahl et al., 1989) and important to central nervous system function (Eisler, 1993), the primary toxic effect of zinc is on zinc-dependent enzymes that regulate RNA and DNA. It is most harmful to aquatic life in conditions of low pH, low alkalinity, low dissolved oxygen, and elevated temperature. Zinc is relatively nontoxic in mammals, but excessive intake can cause a variety of effects. It is not known to be carcinogenic by normal exposure routes (Eisler, 1993).

Gastrointestinal absorption of zinc is variable (20-80%) and depends on the chemical compound as well as on zinc levels in the body and on dietary concentrations of other nutrients (EPA, 1984). Information on pulmonary absorption is limited and complicated by the potential for gastrointestinal absorption due to mucociliary clearance from the respiratory tract and subsequent swallowing. Pulmonary inflammation and changes in lung function have been observed in inhalation studies on animals (Amur et al., 1982; Lam et al., 1985; Drinker and Drinker, 1928). Zinc is present in all tissues with the highest concentrations in the prostate, kidney, liver, heart, and pancreas. Zinc is a vital component of many metalloenzymes such as carbonic anhydrase, which regulates $CO_2$ exchange (Stokinger, 1981).

In animals, gastrointestinal and hepatic lesions (Allen et al., 1983; Brink et al., 1959), pancreatic lesions (Maita et al., 1981; Drinker et al., 1927), anemia (ATSDR, 1989; Fox and Jacobs, 1986; Maita et al., 1981), and diffuse nephrosis (Maita et al., 1981; Allen et al., 1983) have been observed following subchronic oral exposures. Anemia and pancreatitis were the major adverse effects observed in chronic animal studies (Aughey et al., 1977; Drinker et al., 1927; Walters and Roe, 1965; Sutton and Nelson, 1937). Teratogenic effects have not been seen in animals exposed to zinc; however, high oral doses can affect reproduction and fetal growth (Ketcheson et al., 1969; Schlicker and Cox, 1967, 1968; Sutton and Nelson, 1937).

Livestock and small mammals are tolerant of extended dietary loadings >100 times the minimum recommended daily zinc requirement (Eisler, 1993). No adverse effects on general health or reproduction were observed in dairy cows fed 1310 mg zinc/kg food (Miller et al., 1989). A diet of 4000–5000 mg zinc/kg food for 18 days resulted in fetotoxicity and poor reproduction in rats (NAS, 1979). Acute oral $LD_{50}$ doses of 350–800 mg zinc/kg body weight have been reported for rats (Eisler, 1993). Wlostowski et al. (1988) recommended 30 mg zinc/kg in the diet of bank voles.

Dogs on diets with up to 1000 mg zinc/kg of food for up to one year showed no measurable signs of damage (NAS, 1979). Horses ingesting >90 mg zinc/kg body weight daily in the vicinity of a lead-zinc smelter exhibited decreased growth and death (NAS, 1979). No effects were observed in mice fed <682 mg zinc/kg food (<109 mg zinc/kg body weight daily) for 13 weeks, but at 6820 mg zinc/kg food adverse effects on growth and survival were documented (Maita et al., 1981). In a 37-day study involving rats, doses of 97 mg/kg-day administered as zinc carbonate in the diet had no adverse effects on the reproductivity of rats (Kinnamon, 1963). European ferrets (*Mustela putorius furo*) fed up to 500 mg zinc/kg for up to 197 days all survived with no significant histopathologies, but those fed 1500 or 3000 mg/kg diet died within 21 days (Straube et al., 1980; Reece et al., 1986). Reproduction ceased entirely in female rats ingesting a diet with 500 mg zinc/kg/day (Sutton and Nelson, 1937), possibly a result of zinc-induced anemia.

Mallards (*Anas platyrhynchos*) fed diets containing >3000 mg zinc/kg for 30 or 60 days suffered leg paralysis, decreased food consumption, and high mortality (Gasaway and Buss, 1972; NAS, 1979). Egg production in Japanese quail (*Coturnix coturnix japonica*) hens fed 15,000 mg zinc (as ZnO)/kg feed for 7 days decreased to near zero within 3 days (Hussein et al., 1988).

Seven percent of 14-day old quail fed 600 mg zinc (as zinc phosphide)/kg feed over 5 days died, 53% of those fed 990 mg/kg died, and 93% of those fed 1634 mg/kg died (Hill and Camardese, 1986). Domestic chicken pullets and hens on a diet with 20,000 mg zinc/kg feed for 5 days were lighter weight by day 5 and produced significantly fewer eggs for 4 weeks following treatment (Palafox and Ho-A, 1980). Eggs collected 14–28 days post-treatment had reduced fertility and hatchability. However, normal growth, egg production, fertility, and hatchability was observed 4–12 weeks post-treatment. Acute oral $LD_{50}$ values for zinc phosphide, a rodenticide, were between 16 and 47 mg/kg body weight in ring-necked pheasants (*Phasianus colchicus*), golden eagles (*Aquila chrysaetos*), mallards, and horned larks (*Eremophila alpestris*) (Hudson et al., 1984), but much of the biocidal action is attributed to the phosphide rather than the zinc (Eisler, 1993).

Diets containing 28, 48, 228, or 2028 mg zinc/kg for 12–44 weeks had no effect on overall egg production by domestic chickens although zinc levels were elevated in hens on the highest zinc diet (Stahl et al., 1990). All day-old chicks fed diets containing 16,000 mg zinc/kg feed for 5 weeks and 80% of those fed 8000 mg/kg died; those on a 4000 mg zinc/kg diet showed no significant reductions in growth or survival (Oh et al., 1979). In a 60-day study, doses of 170 mg/kg-day administered as zinc carbonate in the diet caused increased mortality and altered blood chemistry in mallards (Gasaway and Buss, 1972).

In chickens, adverse effects associated with zinc deficiency have been observed at <38 mg zinc/kg dry weight feed (Blamberg et al., 1960; Westmoreland and Hoekstra, 1969; Stahl et al., 1989), but concentrations of 93–120 mg/kg are suggested as adequate in the diet (Blamberg et al., 1960; Westmoreland and Hoekstra, 1969). Greater than 178 mg/kg dry weight feed is considered excessive (Stahl et al., 1989), and dietary concentrations >2000 mg/kg dry weight feed are considered toxic (NAS, 1979; Oh et al., 1979; Stahl et al., 1990). Turkey poults tolerated zinc levels up to 2000 ppm in starter diets for 21 days with no deleterious effects, but levels ≥4000 ppm resulted in marked growth depression (Vohra and Kratzer, 1968). No mortality was observed in poults on a diet containing 10,000 ppm zinc (Vohra and Kratzer, 1968), but increased mortality has been observed for chickens on diets with 3000 ppm zinc (Roberson and Schaible, 1960).

# Appendix E

# REPRODUCTIVE PERFORMANCE OF MINK

# REPRODUCTIVE PERFORMANCE OF MINK

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## 1. INTRODUCTION

Plant operations and waste disposal at the Oak Ridge National Laboratory (ORNL), the Gaseous Diffusion Plant (ORGDP), and the Weapons Plant (Y-12) have introduced an assortment of potentially harmful contaminants into the surrounding environment (Ashwood et al. 1986, Suter 1990). The potential for off-reservation transport of contaminants by streams on the Oak Ridge Reservation (ORR) that empty into the Clinch and Tennessee River systems is a concern.

Contaminants of special concern include mercury (Hg) and polychlorinated biphenyls (PCB's) (Suter 1990). Elevated concentrations of Hg and PCB's have been found in fish collected from East Fork Poplar Creek (EFPC) and Bear Creek, and elevated concentrations of PCB's also have been found in fish from White Oak Creek (Loar 1990). East Fork Poplar Creek and Bear Creek originate within the Y-12 Plant and flow into Poplar Creek north of the K-25 Plant and White Oak Creek flows through ORNL. Both creeks empty into the Clinch River on the upper reach of Watts Bar Lake. In the Screening Level Risk Assessment for the Off-Site Ecological Effects in Surface Waters Downstream from the U.S. Department of Energy Oak Ridge Reservation, Suter (1990) indicated that piscivorous wildlife along the Clinch River are at risk.

Mink (*Mustela vison*) have been shown to be among the most sensitive, if not the single most sensitive, mammalian species to polychlorinated biphenyl (PCB) toxicity (Aulerich and Ringer 1977). Feeding studies conducted by Aulerich *et al.* (1971, 1973), Hornshaw *et al.* (1983), and Heaton (1992) have demonstrated the extreme sensitivity of mink to chlorinated hydrocarbon contaminants, especially PCBs, contained in fish taken from the Great Lakes. Additional studies have shown this species also to be sensitive to other halogenated hydrocarbons, including polybrominated biphenyls (Aulerich and Ranger 1979), hexachlorobenzene (Bleavins *et al.* 1988) and mercury (Hg) (Aulerich et al. 1974, Wobeser and Swift 1976, Wobeser et al. 1976). Numerous other toxicological studies with mink have been reported in the literature (Scientifur 1987, Sundqvist 1989, Leonards et al. 1994) and summarized by Calabrese *et al.* (1992). In addition, mink have been recommended as an indicator species for the goal of virtual elimination of persistent toxic substances in the Great Lakes by the International Joint Commission Virtual Elimination Task Force Biomarker Workshop (personal communication from Glen Fox, Environment Canada, Ottawa, Ontario).

Because mink are sensitive to PCB and Hg toxicity and inhabit wetland areas, they are potentially good indicators of environmental effects of these chemicals in aquatic habitats. However, mink are secretive and population densities tend to be low (male home ranges average 2,600 m in stream length, Dunstone 1993), making assessment of environmental contaminant effects in natural populations difficult. Since it is known that fish inhabiting aquatic systems downstream from the Oak Ridge Reservation (ORR) contain elevated concentrations of PCBs and Hg (Sect. 3.5.1), and that fish are a major food item of mink, the objectives of this study were to compare biological accumulation of environmental contaminants and reproductive effects in mink fed fish collected on the ORR to accumulation and effects in mink fed fish collected from the Clinch River above the ORR, or from the ocean.

## 2. MATERIALS AND METHODS

### 2.1 Fish Collection and Diet Preparation

Fish used in mink diets were collected from the reach of Poplar Creek between East Fork Poplar Creek and the confluence of Poplar Creek with the Clinch River (on the ORR) and from the Clinch River above Melton Hill Dam near Bull Run Power Plant (above the ORR), or were ocean fish (mackerel) obtain from a commercial supplier. Fish collected on the ORR and above the ORR were identified, weighted, placed in labeled plastic bags, frozen and shipped on dry ice for overnight delivery to the Michigan State University (MSU) Experimental Fur Farm. Ocean fish were frozen and shipped directly to MSU by a commercial supplier. At MSU, fish collected from the same location were ground through a 3/8 inch plate and mixed in a paddle mixer. This process was repeated until all fish from the same location were ground and mixed together so that a homogeneous mixture was obtained. Ten aliquots of the homogeneous mixture were placed in whirlpac bags, labelled, and frozen for contaminant analyses. This process was repeated for fish collected from each source.

Five diets, each composed of 75% fish and 25% normal ranch mink chow, were prepared. Appropriate proportions of homogenized fish from prescribed locations were blended with components of normal mink diet (eggs, liver, vitamin and mineral premix, d-biotin, and cereal). The fish portion of 2 diets (A and B) contained 75% ocean fish and 75% fish collected above the ORR (Clinch River above Melton Hill Dam), respectively. These served as reference diets for this study. The fish portion of the remaining 3 diets (C, D, and E) contained 25, 50 and 75% fish collected on the ORR and 50, 25, and 0% ocean fish, respectively. All diets were formulated to meet the nutrient requirements of the mink (NRC, 1982). Diet proximate analyses were determined by MSU. Ten aliquots of each diet were placed in whirlpac bags, labelled, and frozen for contaminant analyses.

### 2.2 Mink Feeding Experiment

Fifty adult, natural dark mink from the MSU Experimental Fur Farm, Michigan State University (MSU), East Lansing, Michigan were uniquely identified and randomly divided into 5 groups of 2 males and 8 females per group. Mink were housed individually in wire cages (61 x 76 x 46 cm) with attached nest boxes (38 x 28 x 27 cm). Cages were suspended above the ground in open-sided sheds. Throughout the study, mink were provided food and drinking water *at libitum* and exposed to ambient temperature and photoperiod. Mink were immunized against canine distemper, virus enteritis, infectious pneumonia, and botulism, and provided thiamine daily to prevent thiamine deficiency resulting form thiaminase in fish. Mink were acclimated to the test facilities for at least one week prior to the definitive test.

Each mink group was fed one of the prepared diets from December 1, 1993 (approximately 3 months prior to breeding) through approximately June 30, 1993 (6 weeks postpartum). Mink were weighed at the beginning of the feeding trials and at monthly intervals thereafter (except during the gestation period). They were observed daily and any behavioral changes or clinical signs of toxicity recorded.

Mating began March 1, 1994 and was confined within the respective groups. Females were given an opportunity to mate every fourth day until a confirmed mating (presence of motile spermatozoa in vaginal aspirations) was obtained. The mated females were given an opportunity for a second mating the day following the initial mating or eight days later (a standard commercial mink ranch practice). The bred females were checked daily during gestation for evidence of whelping. The gestation period of mink averages 51 days but is highly variable (42 to 65 days) due to delayed implantation. Whelped kits were counted, sexed, and weighed on the day of birth and at three and six weeks of age. Mink kits begin to consume solid feed at 21 to 24 days of age and are weaned at 6 weeks. Thus, kit body weight at 3 weeks of age provides a good indication of the lactational performance of the female. Reproductive indices measured included: number of females mated; number of females whelping; length of gestation; number of kits whelped (alive, dead); kit sex ratio; average kit body weight at birth, 3, and 6 weeks of age; and kit survival to 3 and 6 weeks of age.

Adult mink with > 30 % decrease in original body weight and all adults at the termination of the study were euthanized ($CO_2$). All adult mink were necropsied, organ (brain, liver, kidneys, heart, lungs, gonads, and adrenal glands) weights were recorded and samples of adipose, liver, kidney, and hair collected for residue analysis. At 6 weeks of age, 3 kits each from 3 randomly selected females from dietary groups A, B, C, and E were euthanized, liver, spleen, and kidneys weighed, and samples (liver, kidney, and remaining carcass) collected for residue analyses. Tissue samples (brain, liver, kidney, heart, lungs, and adrenal gland) also were collected from adult mink and preserved in 10% formalin for histopathologic examination.

Ten aliquots, each, of homogenized fish and mink diets, and collected mink tissues were shipped frozen to the Southwest Research Institute, San Antonio, TX for PCB (Aroclors), CB (congeners) and mercury concentration determination. Adult mink liver and fat tissues and kidney, liver, and hair tissues were analyzed for Aroclor and CB concentrations, and mercury concentration, respectively. Liver tissue also was analyzed for ethoxyresorufin-o-deethylase (EROD) activity. Kit whole carcass and liver tissue, and whole carcass and kidney tissues were analyzed for PCB and CB concentrations, and mercury concentration, respectively. Lipid concentration (% lipid) was determined for all samples analyzed for PCBs

PCB Aroclor and congener results were adjusted for lipid concentration (tissue concentrations divided by the % lipid) prior to statistical analysis. Results of contaminant analyses, physiological measurements, and reproductive parameters were statistically evaluated for differences among diet groups and between diet groups A or B and E using non-parametric (Wilcoxon or Kruskel-Wallis) and gausian (t-test or ANOVA) tests.

## 3. RESULTS

The species composition of fish collected from the ORR and the Clinch River above Melton Hill Dam were similar and consisted mostly of benthic species (Table E.1). Mean mercury concentrations were significantly different among fish collected from the ORR, Clinch River, or ocean (Table E.2). Mean mercury concentrations in mink diets increased progressively from diet A through diet E (Table E.2). Correspondingly, mercury concentrations in liver, kidney, and hair of adult female mink increased progressively in mink fed diets A through E (Table E.3). Mercury concentrations in kit kidney tissue and homogenized carcass were not significantly different in offspring of mink fed diets A, B, or C, but were significantly greater ($P < 0.05$) in offspring of mink fed diet E (Table E.3).

### 3.1 PCB and Congener Profiles in Fish and Mink Diets

Aroclor 1260 was the dominant Aroclor detected in aliquots of homogenized fish, mink diets, and tissues of adult mink and kits, although Aroclor 1254 also was quantified in several tissue samples. Aroclor 1260 was quantified in aliquots of all diets except for diet A (75% ocean fish), in fat tissue from mink in all diet groups except diet group C, and in liver tissue of mink from diet groups D and E. Twenty-three specific congeners, including 8 coplanar congeners (non-ortho or mono-ortho congeners), were evaluated in homogenized fish, diets, liver and fat tissues of adult mink, and liver tissue and carcass of kits. Ninety-six percent of congener concentrations were significantly different among ocean, ORR, and Clinch River homogenized fish, including all but one coplanar congeners (Table E.4). In all cases where significant differences existed in homogenized fish congener concentrations among collection sites, the greatest concentrations were in fish collected from the ORR. Aroclor 1260 and 87% of the congener evaluated also were quantified in mink diets (Table E.5). Mean Aroclor 1260 concentration was significantly greater ($P < 0.01$) in diet E compared to concentrations other diets. Coplanar CBs 126 and 189 were not detected in any diets, CB 156 was detected in low concentrations in diets B, C, and D, and CBs 77 and 81 were quantified in low concentrations in diets C, D, and E, while CB 167 was only quantified in diets D and E. Concentrations of coplanar CB 118 were significantly greater ($P < 0.01$) in aliquots of diet E compared to aliquots of the other diets. Mean concentrations of CB 123 progressively increased from diet C to D, however, quantified concentrations in diet E were surprisingly lower than concentrations in diet C. Low concentrations of this CB in diet E are thought to result from matrix interference in this diet. Similarly, lower than expected concentrations were quantified for CBs 99, 101, 156, and 171 in diet E. The remaining non-plainer congener concentrations were generally greatest in aliquots from diet E (Table E.5).

### 3.2 PCB and Congener Profile in Mink Tissues

Mean Aroclor 1260 concentration was significantly greater in liver tissue of female mink fed diet E (Table E.6). Coplanar CB 189 was quantified at low concentrations (<21 ppb) in liver tissue from all mink fed diet E, 50% of those fed diet D, and less than 10% of those fed diets A, B, or C. Liver concentrations of CB 126 were significantly greater ($P < 0.01$) in samples collected from female mink fed diet E. Low concentrations (<32 ppb) of CB 126 also were quantified in liver tissue from female mink fed diets B and D. Mean liver concentrations of coplanar CBs 77 and 81 were ≤ 6 ppb in all female mink regardless of diet. Mean concentrations of CBs 156 and 167 increased progressive in liver tissue from female mink fed diets A - E and were significantly greater ($P < 0.01$) in mink fed diet E compared to those fed diets A or B. Mean concentration of coplanar CBs 118 and

123 were significantly greater in liver tissue from female mink on diet E compared to concentrations in liver tissue from mink fed diets A or B. There were significant differences ($P < 0.05$) in all female mink liver tissue non-planar congener concentrations among diet groups. For all non-planar congener in female liver tissue, concentrations were significantly greater ($P < 0.05$) in tissues from diet E mink compared to diet A mink, except for concentrations of CBs 195 and 196 which were not significantly different. Similarly, mean female mink liver concentrations of all non-planar congeners were significantly greater in female mink liver from diet group E mink compared to diet group B mink, except for CBs 146, 153, 170, 180, 183, and 201 which were not significantly different between these diet groups.

Mean Aroclor 1260 concentration in fat tissue from female mink fed diet E were significantly greater than mean concentrations from female mink fed diets A or B (Table E.7). Mean concentrations of all coplanar CBs were significantly greater ($P < 0.05$) in fat tissue from female mink fed diet E compared to mean concentrations in mink fed diets A or B, except that there was no difference in CB 126 fat concentration between female mink fed diets E and B. Non-planar CB mean concentrations were significantly greater ($P < 0.05$) in fat tissue from female mink fed diet E compared to mean concentrations in mink fed diets A or B, except CBs 170, 194, and 195. There was no difference between CB 170 or 194 mean fat concentrations between female mink fed diets B or E, and mean fat concentration of CB 195 in female mink was significantly greater ($P < 0.05$) in female mink fed diet B compared to diet E.

Concentrations of coplanar CBs 77, 81, 123, 156, and 189 were < 20 ppb in liver tissue from kits in all diet groups (Table E.8). Concentrations of coplanar CBs 118, 126, and 167 were significantly greater ($P < 0.05$) in liver from diet E kits compared to those from diets A, B, or C. Concentrations of non-planar CBs 101, 151, 171, and 195 were < 15 ppb in liver tissue from kits in all diet groups. Concentrations of the remaining non-planar CBs quantified were greater in liver tissue of diet E kits.

The pattern of concentrations of coplanar CBs in kit carcass homogenates from the various diets were similar to those observed in kit liver tissue (Table E.9). Except, the concentration of coplanar CB 126 was < 25 ppb in kit carcass homogenates and the concentration of CB 156 was significantly greater ($P < 0.05$) in kit carcass homogenates from diet group E compared to other diet groups. Concentration patterns of non-planar CBs in the various diet groups also were similar in carcass homogenates compared to concentrations in liver tissue. Except concentrations of CBs 151 and 196 were the only CBs with concentrations < 25 ppb. Concentrations of all other CBs quantified were greater in homogenized carcasses of kits from diet group E.

### 3.3 Physiological and Reproductive Effects

Two mink from diet group A, one male and one female, died during the experimental period. The male died on March 18, 1994 from hemorrhagic and necrotizing cystitis and the female died on April 24, 1994 due to complications during parturition. In addition to these adult mink, kits from one female in diet group B developed staph infections and all but one diet prior to 6 weeks of age.

One, 2, and 4 females did not whelp in diet groups A and B, D, and C, respectively (Table E.10). Two females that did not whelp (1 from diet group A and 1 from diet group C) had cyst in the reproductive tracts that probably interfered with normal reproduction. Two females that did not whelp (1 from diet group C and 1 from diet group D) had no placental scars in the uterus and therefore probably were not pregnant. The reason the remaining 4 females did not whelp is unknown.

Mean whole body weights of female mink were not significantly different among diet groups at the beginning of the experimental period, however, mean weights of females in diet group E were significantly less (P=0.03) than mean weights of females in diet group A at the end of the experimental period (Table E.10). Mean female relative organ weights (organ weights/body weight) were not significantly different among diet groups. At 6 weeks of age, mean whole body weights were significantly lower (P=0.004) in male kits from diet group E compared to those from diet group A. A similar trend was observed in 6 week old female kits, although differences were not statistically significant. Mean relative kidney weights were significantly lower (P=0.003) in kits from diet group B ($\bar{x}$ = 1.0 g) compared to those from diet group E ($\bar{x}$ = 1.3 g). Kit mean relative liver and spleen weights were not significantly different among diet groups. No histological lesions were attributed to diets.

Mean litter size was significantly reduced (P=0.01) in diet group E compared to diet groups A, B, and C but not diet group D (Table E.10). Liver EROD activity was significantly increased in adult female mink from diet groups D and E compared to those from diet group A (Table E.10).

Although concentrations of mercury and PCBs were greater in fish collected from streams located on the ORR and these contaminants were higher in diets fed to mink with increasing percentage of ORR fish, reproductive effects were only noted in mink fed 75% ORR fish. Liver EROD activity, a sensitive biomarker of exposure to PCBs increased in mink fed diets containing 50% and 75% fish collected from the ORR.

Although fish are a major food item in the diet of wild mink, the proportion of fish in their diets normally does not exceed 40-60%. However, in addition to fish, concentrations of contaminants in other food items (crayfish, frogs, muskrat, ducks, and reodents) need to be evaluated in assessing effects of contaminants on mink living on the ORR.

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**Table E.1. Percent by weight of the most common fish species collected from the ORR and Clinch River above Melton Hill Dam**

| Common name | ORR % | Weight kg | Clinch River % | Weight kg |
|---|---|---|---|---|
| Sucker | 17 | 280 | 3 | 12 |
| Carp | 20 | 330 | 24 | 97 |
| Catfish | 15 | 248 | 13 | 53 |
| Shad | 7 | 116 | 6 | 24 |
| Buffalo | 17 | 280 | 42 | 170 |
| Other species | 24 | 396 | 12 | 49 |
| TOTALS | 100 | 1,650 | 100 | 405 |

Table E.2. Mean mercury concentrations (ppm, wet wt) in homogenized fish[1] collected on the ORR[2], Clinch River above the ORR[3], and from the ocean[4] and diets fed to mink

| | N[5] | MEAN[6] | SE | MIN | MAX |
|---|---|---|---|---|---|
| **LOCATION** | | | | | |
| On the ORR | 10 | 0.35[a] | 0.03 | 0.17 | 0.43 |
| Clinch River | 10 | 0.07[b] | 0.00 | 0.05 | 0.09 |
| Ocean | 10 | 0.03[c] | 0.00 | 0.02 | 0.04 |
| **DIET** | | | | | |
| A[7] | 10 | 0.02[a] | 0.00 | 0.02 | 0.03 |
| B[8] | 10 | 0.05[b] | 0.00 | 0.04 | 0.06 |
| C[9] | 10 | 0.09[c] | 0.00 | 0.08 | 0.11 |
| D[10] | 10 | 0.15[d] | 0.01 | 0.12 | 0.18 |
| E[11] | 10 | 0.22[e] | 0.01 | 0.16 | 0.24 |

[1]Various fish species.
[2]Poplar Creek between East Fork Poplar Creek and confluence with the Clinch River.
[3]Above Melton Hill Dam near Bull Run Power Plant.
[4]Mackerel purchased from commercial supplier.
[5]Number of aliquots analyzed.
[6]Means followed by different letters are significantly different, $P<0.05$.
[7]75% ocean fish, 25% ranch mink diet.
[8]75% fish collected from the Clinch River above the Oak Ridge Reservation (ORR), 25% ranch mink diet.
[9]25% fish collected from Poplar Creek on the ORR, 50% ocean fish, 25% ranch mink diet.
[10]50% fish collected from Poplar Creek on the ORR, 25% ocean fish, 25% ranch mink diet.
[11]75% fish collected from Poplar Creek on the ORR, 25% ranch mink diet.

**Table E.3. Mercury concentration (ppm, wet wt) in tissues from female mink fed (n=8/diet) various diets[1] and their 6-week-old kits**

| | | Diet A | Diet B | Diet C | Diet D | Diet E |
|---|---|---|---|---|---|---|
| **ADULT FEMALE MINK** | | | | | | |
| Liver Hg | Mean[2] | $0.41^{a}$ | $0.61^{a}$ | $1.06^{a}$ | $1.93^{b}$ | $3.67^{c}$ |
| | SE | 0.07 | 0.06 | 0.10 | 0.15 | 0.32 |
| | Range | 0.17-0.8 | 0.47-0.87 | 0.74-1.49 | 1.26-2.47 | 2.52-5.20 |
| Kidney Hg | Mean | $0.84^{a}$ | $1.25^{ab}$ | $2.22^{bc}$ | $3.47^{cd}$ | $4.35^{d}$ |
| | SE | 0.13 | 0.18 | 0.35 | 0.52 | 0.34 |
| | Range | 0.25-1.46 | 0.53-1.96 | 1.24-4.22 | 2.38-7.00 | 3.33-6.25 |
| Hair Hg | Mean | $3.79^{a}$ | $7.43^{b}$ | $7.71^{b}$ | $13.44^{c}$ | $19.03^{d}$ |
| | SE | 0.26 | 0.55 | 0.63 | 0.79 | 0.57 |
| | Range | 2.20-4.61 | 5.05-9.70 | 4.38-9.62 | 10.2-15.6 | 16.8-21.4 |
| **KITS** | | | | | | |
| Carcass | Mean | $0.02^{a}$ | $0.03^{a}$ | $0.05^{a}$ | | $0.20^{b}$ |
| | SE | 0.004 | 0.003 | 0.003 | | 0.02 |
| | Range | 0.01-0.05 | 0.02-0.05 | 0.04-0.06 | | 0.10-0.30 |
| | N | 9 | 9 | 8 | | 9 |
| Kidney Hg | Mean | $0.03^{a}$ | $0.03^{a}$ | $0.06^{a}$ | | $0.19^{b}$ |
| | SE | 0.001 | 0.003 | 0.003 | | 0.02 |
| | Range | 0.02-0.04 | 0.02-0.04 | 0.05-0.07 | | 0.11-0.31 |
| | N | 9 | 9 | 8 | | 9 |

[1]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.
[2]Means with different superscripts are significantly different, $P<0.05$.

**Table E.4. Mean[1] ±SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in homogenized fish[2] collected on the ORR[3], Clinch River above the ORR[4], and from the ocean[5]**

| | Ocean | Clinch River | ORR |
|---|---|---|---|
| CB 77 | 0.022$^{a}$±0.000 (10) | 0.039$^{b}$±0.001 (10) | 0.190$^{c}$±0.004 (10) |
| CB 81 | 0.053$^{a}$±0.001 (10) | 0.592$^{b}$±0.062 (10) | 1.419$^{c}$±0.262 (9) |
| CB 99 | 0.022$^{a}$±0.000 (10) | 0.076$^{b}$±0.011 (10) | 0.894$^{c}$±0.015 (10) |
| CB 101 | 0.022$^{a}$±0.000 (10) | 0.142$^{b}$±0.022 (10) | 0.609$^{c}$±0.010 (10) |
| CB 118 | 0.022$^{a}$±0.000 (10) | 0.468$^{ab}$±0.219 (10) | 1.150$^{b}$±0.030 (9) |
| CB 123 | 0.022$^{a}$±0.000 (10) | 0.039$^{ab}$±0.001 (10) | 0.051$^{b}$±0.010 (10) |
| CB 126 | 0.022$^{a}$±0.000 (10) | 0.039$^{b}$±0.001 (10) | 0.041$^{b}$±0.001 (10) |
| CB 128 | 0.022$^{a}$±0.000 (10) | 0.178$^{b}$±0.003 (10) | 0.636$^{c}$±0.012 (10) |
| CB 138 | 0.022$^{a}$±0.000 (10) | 0.706$^{b}$±0.014 (10) | 1.611$^{c}$±0.052 (9) |
| CB 146 | 0.022$^{a}$±0.000 (10) | 0.388$^{b}$±0.007 (10) | 0.822$^{c}$±0.023 (10) |
| CB 151 | 0.039$^{a}$±0.002 (10) | 0.496$^{b}$±0.008 (10) | 1.731$^{c}$±0.048 (10) |
| CB 153 | 0.074$^{a}$±0.002 (10) | 2.813$^{b}$±0.082 (10) | 4.733$^{c}$±0.123 (9) |
| CB 156 | 0.022$^{a}$±0.000 (10) | 0.039$^{b}$±0.001 (10) | 0.078$^{b}$±0.037 (10) |
| CB 167 | 0.022$^{a}$±0.000 (10) | 0.044$^{b}$±0.003 (10) | 0.193$^{c}$±0.003 (10) |
| CB 170 | 0.022$^{a}$±0.000 (10) | 0.455$^{b}$±0.010 (10) | 1.315$^{c}$±0.025 (10) |
| CB 171 | 0.022$^{a}$±0.000 (10) | 0.039$^{b}$±0.001 (10) | 0.041$^{b}$±0.001 (10) |
| CB 180 | 0.022$^{a}$±0.000 (10) | 3.021$^{b}$±0.099 (10) | 3.592$^{c}$±0.088 (10) |
| CB 183 | 0.022$^{a}$±0.000 (10) | 0.690$^{b}$±0.012 (10) | 1.000$^{c}$±0.016 (10) |
| CB 189 | 0.022$^{a}$±0.000 (10) | 0.039$^{b}$±0.001 (10) | 0.041$^{b}$±0.001 (10) |
| CB 194 | 0.022$^{a}$±0.000 (10) | 0.376$^{b}$±0.009 (10) | 0.430$^{c}$±0.006 (10) |
| CB 195 | 0.022$^{a}$±0.000 (10) | 0.042$^{b}$±0.002 (10) | 0.043$^{b}$±0.002 (10) |
| CB 196 | 0.022$^{a}$±0.000 (10) | 0.570$^{b}$±0.014 (10) | 1.660$^{c}$±0.041 (10) |
| CB 201 | 0.022$^{a}$±0.000 (10) | 0.486$^{b}$±0.009 (10) | 0.605$^{c}$±0.008 (10) |
| Aroclor 1260 | 0.379$^{a}$±0.008 (10) | 21.917$^{b}$±0.681 (10) | 28.997$^{c}$±0.659 (10) |

[1]Means with different superscripts are significantly different, $P<0.05$.
[2]Various fish species.
[3]Poplar Creek between East Fork Poplar Creek and confluence with the Clinch River.
[4]Above Melton Hill Dam near Bull Run Power Plant.
[5]Mackerel purchased from commercial supplier.

**Table E.5. Mean ±SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in mink diets[1] (n=10/diet)**

| | Diet A | Diet B | Diet C | Diet D | Diet E |
|---|---|---|---|---|---|
| CB 77 | 0.025±0.000 | 0.037±0.001 | 0.046±0.003 | 0.102±0.002 | 0.116±0.005 |
| CB 81 | 0.027±0.002 | 0.337±0.051 | 0.507±0.011 | 0.873±0.022 | 1.158±0.033 |
| CB 99 | 0.025±0.000 | 0.037±0.001 | 0.276±0.011 | 0.531±0.014 | 0.520±0.013 |
| CB 101 | 0.031±0.004 | 0.239±0.032 | 0.288±0.009 | 0.585±0.012 | 0.396±0.020 |
| CB 118 | 0.025±0.000 | 0.117±0.010 | 0.192±0.007 | 0.405±0.007 | 0.668±0.021 |
| CB 123 | 0.025±0.000 | 0.037±0.001 | 0.212±0.008 | 0.446±0.008 | 0.076±0.003 |
| CB 126 | 0.025±0.000 | 0.037±0.001 | 0.027±0.001 | 0.038±0.003 | 0.033±0.001 |
| CB 128 | 0.025±0.000 | 0.085±0.003 | 0.104±0.004 | 0.228±0.005 | 0.351±0.013 |
| CB 138 | 0.080±0.002 | 0.791±0.087 | 0.331±0.011 | 0.690±0.009 | 1.048±0.020 |
| CB 146 | 0.025±0.000 | 0.037±0.001 | 0.141±0.006 | 0.335±0.007 | 0.501±0.015 |
| CB 151 | 0.025±0.000 | 0.314±0.010 | 0.254±0.009 | 0.555±0.009 | 1.058±0.039 |
| CB 153 | 0.025±0.000 | 1.862±0.025 | 0.766±0.029 | 1.772±0.026 | 3.126±0.056 |
| CB 156 | 0.025±0.000 | 0.139±0.013 | 0.065±0.002 | 0.094±0.015 | 0.033±0.001 |
| CB 167 | 0.025±0.000 | 0.037±0.001 | 0.027±0.001 | 0.061±0.003 | 0.103±0.004 |
| CB 170 | 0.025±0.000 | 1.847±0.964 | 0.154±0.007 | 0.346±0.008 | 0.798±0.016 |
| CB 171 | 0.025±0.000 | 0.037±0.001 | 0.061±0.002 | 0.127±0.003 | 0.033±0.001 |
| CB 180 | 0.025±0.000 | 1.011±0.266 | 0.507±0.019 | 1.091±0.018 | 2.292±0.040 |
| CB 183 | 0.025±0.000 | 0.276±0.053 | 0.170±0.006 | 0.355±0.007 | 0.573±0.019 |
| CB 189 | 0.025±0.000 | 0.037±0.001 | 0.027±0.001 | 0.031±0.000 | 0.033±0.001 |
| CB 194 | 0.025±0.000 | 0.058±0.022 | 0.072±0.008 | 0.149±0.020 | 0.245±0.009 |
| CB 195 | 0.025±0.000 | 0.039±0.003 | 0.027±0.001 | 0.033±0.002 | 0.033±0.001 |
| CB 196 | 0.025±0.000 | 1.081±0.084 | 0.184±0.008 | 0.415±0.008 | 1.071±0.024 |
| CB 201 | 0.025±0.000 | 0.230±0.034 | 0.060±0.002 | 0.131±0.003 | 0.338±0.010 |
| Aroclor 1260 | 0.169±0.002 | 11.440±0.327 | 4.697±0.174 | 10.405±0.250 | 20.670±0.458 |

[1]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

**Table E.6. Mean ±SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in liver tissue from female mink (n=8/diet) fed various diets[1]**

| | Diet A | Diet B | Diet C | Diet D | Diet E |
|---|---|---|---|---|---|
| CB 77 | 0.048±0.016 | 0.081±0.010 | 0.033±0.004 | 0.095±0.040 | 0.028±0.005 |
| CB 81 | 0.048±0.016 | 0.054±0.010 | 0.033±0.004 | 0.095±0.040 | 0.197±0.117 |
| CB 99 | 0.048±0.016 | 0.117±0.014 | 0.420±0.061 | 0.962±0.123 | 0.823±0.215 |
| CB 101 | 0.048±0.016 | 0.053±0.011 | 0.033±0.004 | 0.145±0.019 | 0.154±0.015 |
| CB 118 | 0.141±0.008 | 0.590±0.040 | 1.066±0.153 | 2.157±0.406 | 1.656±0.332 |
| CB 123 | 0.048±0.016 | 0.041±0.006 | 0.033±0.004 | 0.095±0.040 | 1.598±0.228 |
| CB 126 | 0.048±0.016 | 0.224±0.023 | 0.033±0.004 | 0.095±0.040 | 1.703±0.251 |
| CB 128 | 0.048±0.016 | 0.174±0.023 | 0.151±0.024 | 0.353±0.054 | 0.691±0.097 |
| CB 138 | 0.136±0.023 | 2.063±0.479 | 2.083±0.224 | 4.816±0.915 | 5.649±0.465 |
| CB 146 | 0.059±0.015 | 0.627±0.051 | 0.545±0.055 | 1.188±0.113 | 0.604±0.111 |
| CB 153 | 0.206±0.020 | 5.075±0.445 | 3.858±0.365 | 8.063±1.195 | 7.242±1.658 |
| CB 156 | 0.048±0.016 | 0.228±0.074 | 0.193±0.037 | 0.480±0.102 | 0.648±0.102 |
| CB 167 | 0.048±0.016 | 0.125±0.013 | 0.166±0.020 | 0.244±0.077 | 0.776±0.100 |
| CB 170 | 0.057±0.015 | 2.249±0.219 | 0.774±0.144 | 1.971±0.444 | 1.878±0.194 |
| CB 171 | 0.048±0.016 | 0.041±0.006 | 0.093±0.013 | 0.217±0.027 | 0.774±0.065 |
| CB 180 | 0.131±0.015 | 6.576±0.772 | 3.117±0.390 | 6.980±1.296 | 7.752±0.815 |
| CB 183 | 0.048±0.016 | 0.412±0.032 | 0.229±0.024 | 0.479±0.097 | 0.527±0.086 |
| CB 189 | 0.048±0.016 | 0.044±0.007 | 0.042±0.007 | 0.137±0.038 | 0.106±0.013 |
| CB 194 | 0.050±0.016 | 1.887±0.208 | 0.803±0.086 | 1.795±0.202 | 1.218±0.174 |
| CB 195 | 0.048±0.016 | 0.041±0.006 | 0.192±0.018 | 0.457±0.035 | 0.115±0.015 |
| CB 196 | 0.068±0.015 | 2.998±0.302 | 0.033±0.004 | 0.095±0.040 | 1.863±0.985 |
| CB 201 | 0.048±0.016 | 2.085±0.261 | 0.245±0.084 | 1.448±0.459 | 2.794±0.356 |
| Aroclor 1260 | 0.344±0.132 | 0.270±0.039 | 0.230±0.021 | 0.723±0.329 | 79.486±8.112 |

[1]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

**Table E.7. Mean ±SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in fat tissue from female mink (n=8/diet) fed various diets[1]**

| | Diet A | Diet B | Diet C | Diet D | Diet E |
|---|---|---|---|---|---|
| CB 77 | 0.011±0.005 | 0.035±0.006 | 0.046±0.006 | 0.083±0.019 | 0.138±0.011 |
| CB 81 | 0.120±0.042 | 0.339±0.061 | 0.280±0.052 | 0.429±0.023 | 0.696±0.078 |
| CB 99 | 0.050±0.018 | 0.169±0.029 | 0.786±0.168 | 1.447±0.265 | 1.708±0.272 |
| CB 101 | 0.016±0.006 | 0.098±0.020 | 0.107±0.018 | 0.263±0.029 | 0.311±0.037 |
| CB 118 | 0.163±0.066 | 0.464±0.089 | 1.461±0.276 | 2.943±0.388 | 3.175±0.299 |
| CB 123 | 0.130±0.036 | 0.458±0.088 | 0.033±0.006 | 0.063±0.006 | 2.375±0.330 |
| CB 126 | 0.064±0.029 | 1.171±0.212 | 0.196±0.032 | 0.481±0.035 | 1.511±0.160 |
| CB 128 | 0.033±0.020 | 0.299±0.048 | 0.352±0.059 | 0.781±0.080 | 1.210±0.097 |
| CB 138 | 0.267±0.135 | 2.800±0.609 | 3.464±0.638 | 9.543±1.036 | 9.925±0.833 |
| CB 146 | 0.041±0.015 | 0.500±0.104 | 0.600±0.097 | 1.421±0.111 | 1.771±0.179 |
| CB 153 | 0.405±0.230 | 5.538±1.069 | 5.195±0.988 | 15.714±1.686 | 15.375±1.349 |
| CB 156 | 0.009±0.003 | 0.469±0.084 | 0.409±0.073 | 0.914±0.086 | 1.188±0.077 |
| CB 167 | 0.040±0.019 | 0.350±0.055 | 0.621±0.109 | 1.347±0.126 | 1.500±0.125 |
| CB 170 | 0.093±0.051 | 2.278±0.471 | 0.800±0.157 | 2.043±0.238 | 3.013±0.168 |
| CB 171 | 0.035±0.017 | 0.521±0.093 | 0.488±0.086 | 1.083±0.100 | 1.393±0.084 |
| CB 180 | 0.290±0.188 | 7.175±1.544 | 5.264±1.034 | 14.571±1.325 | 14.750±1.161 |
| CB 183 | 0.019±0.012 | 0.559±0.102 | 0.368±0.069 | 0.899±0.073 | 1.114±0.143 |
| CB 189 | 0.005±0.001 | 0.090±0.019 | 0.041±0.006 | 0.130±0.015 | 0.186±0.018 |
| CB 194 | 0.060±0.035 | 2.103±0.475 | 0.918±0.174 | 2.386±0.201 | 2.688±0.351 |
| CB 195 | 0.011±0.007 | 0.419±0.078 | 0.033±0.006 | 0.063±0.006 | 0.133±0.021 |
| CB 196 | 0.021±0.014 | 0.778±0.163 | 0.426±0.091 | 1.064±0.105 | 1.645±0.295 |
| CB 201 | 0.031±0.019 | 0.889±0.151 | 0.477±0.080 | 1.226±0.101 | 1.813±0.178 |
| Aroclor 1260 | 3.169±1.849 | 61.250±12.560 | 0.261±0.044 | 105.86±11.26 | 128.63±7.73 |

[1]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table E.8. Mean[1] ±SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in liver tissue from 6-week-old mink kits from dams fed diets of fish collected from various sources[2]

| | Diet A | Diet B | Diet C | Diet E |
|---|---|---|---|---|
| CB 77 | 0.003±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 81 | 0.004±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.007±0.001 (9) |
| CB 99 | 0.003[a]±0.000 (9) | 0.006[a]±0.001 (9) | 0.016[a]±0.005 (8) | 0.049[b]±0.012 (9) |
| CB 101 | 0.004±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 118 | 0.012[a]±0.001 (9) | 0.012[a]±0.002 (9) | 0.068[b]±0.014 (8) | 0.138[c]±0.025 (9) |
| CB 123 | 0.008±0.001 (9) | 0.007±0.000 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 126 | 0.003[a]±0.000 (9) | 0.007[a]±0.001 (9) | 0.007[a]±0.001 (8) | 0.014[b]±0.003 (9) |
| CB 128 | 0.003[a]±0.000 (9) | 0.006[a]±0.001 (9) | 0.020[a]±0.005 (8) | 0.092[b]±0.034 (9) |
| CB 138 | 0.015[a]±0.002 (9) | 0.058[a]±0.011 (9) | 0.141[a]±0.033 (8) | 0.547[b]±0.200 (9) |
| CB 146 | 0.004[a]±0.000 (9) | 0.011[a]±0.002 (9) | 0.033[a]±0.006 (8) | 0.143[b]±0.042 (9) |
| CB 151 | 0.004±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 153 | 0.011[a]±0.002 (9) | 0.065[a]±0.010 (9) | 0.157[a]±0.039 (8) | 0.509[b]±0.137 (9) |
| CB 156 | 0.003±0.000 (9) | 0.008±0.001 (9) | 0.009±0.001 (8) | 0.006±0.001 (9) |
| CB 167 | 0.004[a]±0.000 (9) | 0.007[a]±0.001 (9) | 0.009[a]±0.002 (8) | 0.028[b]±0.007 (9) |
| CB 170 | 0.004[a]±0.000 (9) | 0.054[a]±0.009 (9) | 0.078[b]±0.014 (8) | 0.294[b]±0.118 (9) |
| CB 171 | 0.003±0.000 (9) | 0.008±0.001 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 180 | 0.006[a]±0.001 (9) | 0.109[a]±0.018 (9) | 0.194[b]±0.040 (8) | 0.629[b]±0.235 (9) |
| CB 183 | 0.004[a]±0.000 (9) | 0.007[a]±0.000 (9) | 0.013[a]±0.004 (8) | 0.035[b]±0.009 (9) |
| CB 189 | 0.003±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.008±0.002 (9) |
| CB 194 | 0.004[a]±0.000 (9) | 0.019[a]±0.003 (9) | 0.041[b]±0.008 (8) | 0.146[b]±0.055 (9) |
| CB 195 | 0.003±0.000 (9) | 0.006±0.001 (9) | 0.007±0.001 (8) | 0.006±0.001 (9) |
| CB 196 | 0.004[a]±0.000 (9) | 0.052[a]±0.011 (9) | 0.084[b]±0.015 (8) | 0.319[b]±0.128 (9) |
| CB 201 | 0.003[a]±0.000 (9) | 0.014[a]±0.002 (9) | 0.027[a]±0.005 (8) | 0.142[b]±0.032 (9) |
| Aroclor 1260 | 0.099±0.016 (9) | 0.151±0.099 (9) | 0.058±0.009 (8) | 0.048±0.008 (9) |

[1]Means with different superscripts are significantly different, $P \leq 0.05$.
[2]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

**Table E.9. Mean[1] ±SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in carcass[2] of 6-week-old mink kits from dams fed diets of fish collected from various sources[3]**

| | Diet A | Diet B | Diet C | Diet E |
|---|---|---|---|---|
| CB 77 | 0.003±0.000 (9) | 0.003±0.000 (9) | 0.003±0.000 (8) | 0.003±0.000 (9) |
| CB 81 | 0.003±0.000 (9) | 0.003±0.000 (9) | 0.003±0.000 (8) | 0.005±0.001 (9) |
| CB 99 | 0.003[a]±0.000 (9) | 0.009[a]±0.003 (9) | 0.017[a]±0.003 (8) | 0.096[b]±0.023 (9) |
| CB 101 | 0.003[a]±0.000 (9) | 0.004[a]±0.001 (9) | 0.006[a]±0.001 (8) | 0.017[b]±0.002 (9) |
| CB 118 | 0.008[a]±0.001 (9) | 0.030[a]±0.009 (9) | 0.071[a]±0.018 (7) | 0.245[b]±0.036 (9) |
| CB 123 | 0.003±0.000 (9) | 0.011±0.005 (9) | 0.003±0.000 (8) | 0.008±0.001 (9) |
| CB 126 | 0.003±0.000 (9) | 0.011±0.001 (9) | 0.005±0.001 (8) | 0.003±0.000 (9) |
| CB 128 | 0.003[a]±0.000 (9) | 0.011[a]±0.004 (9) | 0.012[a]±0.002 (8) | 0.054[b]±0.007 (9) |
| CB 138 | 0.008[a]±0.001 (9) | 0.112[a]±0.016 (9) | 0.106[a]±0.021 (7) | 0.634[b]±0.110 (9) |
| CB 146 | 0.003[a]±0.000 (9) | 0.013[a]±0.002 (9) | 0.019[a]±0.003 (8) | 0.103[b]±0.017 (9) |
| CB 151 | 0.003±0.000 (9) | 0.003±0.000 (9) | 0.003±0.000 (8) | 0.005±0.001 (9) |
| CB 153 | 0.009[a]±0.001 (9) | 0.141[a]±0.024 (9) | 0.119[a]±0.025 (7) | 0.619[b]±0.096 (9) |
| CB 156 | 0.003[a]±0.000 (9) | 0.017[ab]±0.003 (9) | 0.022[b]±0.003 (8) | 0.058[c]±0.008 (9) |
| CB 167 | 0.003[a]±0.000 (9) | 0.014[bc]±0.002 (9) | 0.010[ab]±0.002 (8) | 0.022[c]±0.003 (9) |
| CB 170 | 0.003[a]±0.000 (9) | 0.073[a]±0.012 (9) | 0.047[a]±0.007 (8) | 0.238[b]±0.036 (9) |
| CB 171 | 0.003[a]±0.000 (9) | 0.021[a]±0.003 (9) | 0.008[a]±0.004 (8) | 0.017[b]±0.002 (9) |
| CB 180 | 0.004[a]±0.000 (9) | 0.203[a]±0.026 (9) | 0.121[a]±0.019 (7) | 0.611[b]±0.080 (9) |
| CB 183 | 0.003[a]±0.000 (9) | 0.011[a]±0.001 (9) | 0.007[a]±0.002 (8) | 0.031[b]±0.005 (9) |
| CB 189 | 0.003±0.000 (9) | 0.003±0.000 (9) | 0.003±0.000 (8) | 0.008±0.001 (9) |
| CB 194 | 0.003[a]±0.000 (9) | 0.025[a]±0.003 (9) | 0.019[a]±0.004 (8) | 0.089[b]±0.010 (9) |
| CB 195 | 0.003[a]±0.000 (9) | 0.003[a]±0.000 (9) | 0.004[a]±0.001 (8) | 0.023[b]±0.003 (9) |
| CB 196 | 0.003±0.000 (9) | 0.014±0.002 (9) | 0.005±0.002 (8) | 0.005±0.001 (9) |
| CB 201 | 0.003[a]±0.000 (9) | 0.013[a]±0.002 (9) | 0.012[a]±0.002 (8) | 0.050[b]±0.009 (9) |
| Aroclor 1260 | 0.082±0.005 (9) | 1.791±0.282 (9) | 0.353±0.245 (8) | 0.049±0.006 (9) |

[1]Means with different superscripts are significantly different, $P<0.05$. Diet groups were separated based on lipid adjusted concentrations.
[2]Whole body minus liver tissue.
[3]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table E.10. Reproductive performance of female mink fed diets of 75% fish from various sources[1]

| | Diet A | Diet B | Diet C | Diet D | Diet E |
|---|---|---|---|---|---|
| Females whelping | 6 | 7 | 4 | 6 | 8 |
| Female weights | | | | | |
| December[2] | 1269±64[3] | 1245±63 | 1374±64 | 1258±64 | 1230±64 |
| June[4] | 1168±84[a] | 1016±81 | 1134±81 | 1020±81 | 935±81[b] |
| Gestation (days) | 44.6 | 46.4 | 44.3 | 47.5 | 44.9 |
| Kit wts (6 wks) | 328±14 | 311±10 | 333±20 | 307±12 | 295±11 |
| Females | 296±38 | | | | 268±37 |
| Males | 376±42[a] | | | | 312±44[b] |
| Litter size[5] | 6.9[a] | 7.3[a] | 7.8[a] | 6.0[ab] | 4.3[b] |
| EROD[6] | 51±13[a] | 134±26[ab] | 124±32[ab] | 276±33[b] | 262.54±31[b] |

[1]Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.
[2]Beginning of study.
[3]Means followed by different superscripts are significantly different, $P<0.05$.
[4]End of study.
[5]Kits/female.
[6]Ethoxyresorufin-o-deethylase, pmoles/mg protein/min.

# Appendix F

# CONTAMINANT ACCUMULATION AND EFFECTS IN GREAT BLUE HERON

# CONTAMINANT ACCUMULATION AND EFFECTS IN GREAT BLUE HERON

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## 1. INTRODUCTION

Plant operations and waste disposal at the Oak Ridge National Laboratory (ORNL), Gaseous Diffusion Plant (ORGDP), and Weapons Plant (Y-12) have introduced an assortment of harmful contaminants into the surrounding environment (Ashwood et al. 1986, Suter 1990). The potential exist for off-reservation transport of contaminants by streams on the Oak Ridge Reservation (ORR) that empty into the Clinch River. Elevated levels of Hg and PCB's have been found in fish collected from East Fork Poplar Creek (EFPC) and from Bear Creek, and elevated levels of PCB's have been found in fish from the White Oak Creek area (Loar 1990). East Fork Poplar Creek and Bear Creek originate within the Y-12 Plant and flow into Poplar Creek north of the K-25 Plant and White Oak Creek flows through ORNL. Both empty into the Clinch River at upper Watts Bar Lake. In the Screening Level Risk Assessment for the Off-Site Ecological Effects in Surface Waters Downstream from the U.S. Department of Energy Oak Ridge Reservation, Suter (1990) identified piscivorous wildlife along the Clinch River as being at risk.

In response to this assessment, monitoring of great blue heron (*Ardea herodias*) was begun in 1991. The great blue heron was chosen as an indicator species because it (1) is predominantly piscivorous foraging along the major waterways on and downstream of the ORR, (2) is at the top of the aquatic food chain, (3) has been suggested to be a good indicator of aquatic health, (3) is well represented in the scientific literature, including toxicological literature, and, (4) satisfies necessary logistical sampling considerations. Important logistical considerations were the presence of study and reference colonies on or in close proximity to ORR and population densities to meet sampling requirements. In addition, great blue heron are highly visible, facilitating direct observation and site location.

This ongoing study seeks to assess the general health and fecundity of the ORR great blue heron population and document any contaminant-induced effects, particularly with respect to Hg and PCB exposure. Reproductive health is of particular concern, and the potential for off-site transportation of contaminants through heron body burdens is addressed.

## 2. STUDY SITES

Four colonies have been utilized for heron chick and egg collection. Two colonies (K25 and Melton Hill colonies) are located within 3 km of ORR and herons utilizing these colonies are potentially exposed to contaminants occurring on the reservation. The remaining two colonies (Long Island and Looney Island colonies) are located >10 Km from the ORR and heron utilizing these colonies are assumed not to be exposed to contaminants that occur on the ORR. In general, there has been an increase in heron colonies in eastern Tennessee resulting from recent range expansion of the great blue heron in the upper Tennessee Valley (Pullin, 1990).

The K-25 colony is located within the boundaries of Oak Ridge Gaseous Diffusion Plant adjacent to Poplar Creek, which flows through this facility. The colony is located on the west bank of Poplar Creek approximately 2 km from the confluence of Poplar Creek and the Clinch River. Fluctuation of the creek water level is dependent on operations at Watts Bar Dam. Areal surveys by the Tennessee Valley Authority (TVA) established nesting activity at K-25 in 1986 and an estimated 31 nests were active in 1988 (Pullin 1990). The number of nest at this colony have remained at 25 - 50 during the 4 years of this study.

The second colony is located among three small islands in Melton Hill Lake approximately 2 km above Melton Hill Dam. This colony has been active for at least four years (personal communication, Jim Evans, TWRA, Oak Ridge National Laboratory). This colony is composed of approximately 40 active nest.

Colonies on Long Island and Looney Island served as off-site reference locations each greater than 10 km from ORR. Long Island is approximately 3 km from the confluence of the Tennessee and Clinch Rivers in the Tennessee River arm of Watts Bar Lake. The colony has been active since at least 1983 and 141 great blue heron nests were active in 1988 (Pullin 1990). Approximately 200 active nests have been observed during each year of the current study.

Looney Island is located in the Tennessee River approximately 30 km upstream of Long Island in upper Fort Loudon Reservoir. The colony has been active since at least 1992 and an estimated 100 active great blue heron nests were observed on the island during the 1993 and 1994 nesting seasons. Black-crowned night herons also were found nesting on this island during both seasons.

## 3. METHODS

During March - June 1992 - 1994 eggs and chicks were collected from great blue heron colonies. Nest were accessed by climbing trees using ropes and ascenders or using tree climbing spikes.

Egg collection and processing

Collected eggs were individually marked at both ends and transported to the laboratory in styrofoam containers. In the laboratory, egg length, width or circumference, and weights were recorded. Eggs were opened by etching the shell along the greatest circumference of the longitudinal axes using a small tooth file. Contents were transferred to acid washed glass containers and examined for embryonic development. Following examination, egg contents were homogenized using a Waring Blender and 2 approximately 20 g aliquots were collected in scintillation vials for metal and PCB analyses. Vials were individually labeled and frozen prior to analyses. Egg shells were dried for >3 days at room temperature and shell weight (±0.1 g) was recorded. Shell thickness (±0.001 mm) was recorded as the average of 6 shell thickness measurements taken at 3 locations on each shell half using a digametic micrometer.

Mercury concentrations in homogenized egg samples collected in 1992 were analyzed by the Analytical Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, TN. Mercury concentration in homogenized egg samples collected in 1993 and 1994 and PCB concentration in homogenized egg samples collected in 1992, 1993, and 1994 was determined by Southwest Research Institute, San Antonio, TX.

Chick collection and necropsy

Collected chicks were lowered to the ground using backpacks. On the ground, a uniquely numbered tag was attached to the leg of each chick. Collected chicks were transported to the laboratory in ventilated turkey boxes prior to weighing, euthanasia, and necropsy. When possible, U.S. Fish and Wildlife bands and ORNL numbered and color coded bands were attached to chicks that were not collected.

In the laboratory, total weight (± 0.1 kg) was measured using a 5 kg spring scale and 3 hematocrit tubes of blood were taken from wing veins followed by euthanasia by asphyxiation with $CO_2$. Total length (from bill tip to end of tail feathers), bill length (from tip to base along dorsal ridge), wing length (from wrist to end of last primary), and tarsometatarsus length (± 1 mm) were recorded. Feathers along the dorsal feather tracts were removed and stored in zip lock plastic bags or aluminum foil prior to metal analysis. An incision was made along the abdomen and the liver, spleen, and heart were removed and weighed (± 0.01 g). Two 1 g liver samples were taken for enzyme and DNA analysis and the remaining liver was divided into two samples, approximately 20 g each, for Hg and PCB analysis. Abdominal fat samples (5 - 10 g) were collected for PCB analysis and 2 approximately 20 g muscle samples were collected from along the tibiotarsus bone for Hg and PCB analysis. All collected tissues were wrapped in aluminum foil, quick frozen in liquid $N_2$, and stored in permanent liquid $N_2$ storage containers or in -80°C freezers. Hematocrits were determined by averaging the pack cell volume of the 3 hematocrit tubes collected from each chick after centrifugation for 15 min.

To assess heron food preference and availability, fish regurgitated from chicks or found beneath nests were collected and crop contents were examined. Recognizable fish samples were archived prior to PCB and Hg analysis. Abnormalities were noted and organ somatic indices were computed.

Results of contaminant analyses, physiological measurements, and reproductive parameters were statistically evaluated for differences between colonies located on and off the ORR. Aroclor 1260 and individual congener differences were evaluated when concentrations in at least one location (on or off ORR) were greater than 30 ppb. For congeners that were evaluated, any concentrations below detection limits were assigned a value equal to half the detection limit. Differences between locations were evaluated using a Student's t-test and, when appropriate, differences among colonies were evaluated using an ANOVA or Kruskal-Wallis test.

## 4. RESULTS

Mercury and chromium concentrations were significantly greater in fish collected from colonies located on the ORR compared to colonies located off the ORR (Table F.1). Although Aroclor 1260 concentrations were quantified in collected fish, no significant differences existed between on and off ORR colonies and all congener concentrations were < 20 ppb.

Egg and Chick Metal concentrations

Thirty-three and 34 eggs and 38 and 35 chicks, respectively, were collected from heron colonies on and off the ORR from 1992 - 1994. Extreme Hg concentrations were quantified in one egg from the Melton Hill colony (KE022, Hg concentration = 0.601 ppm) and one egg from the Long Island colony (LE513, Hg concentration = 0.596 ppm). The egg from the Melton Hill colony was collected from a nest with 2 chicks approximately 2 weeks of age and this egg did not show signs of development. Egg LE513 was collected from a nest that contained 3 eggs and was in an early stage of development. Both concentrations were rejected as outliers by the Dixon and Grubbs test for outlying observations and were eliminated from the data set (Taylor 1987).

No difference existed between mean mercury concentrations in eggs collected from the Long Island and Looney Island colonies (Table F.2), therefore, data from both colonies were used in calculating differences between on and off ORR mercury concentrations in eggs. However, mean mercury concentration in eggs collected from the K25 colony ($\bar{x} \pm SE = 0.17 \pm 0.02$, ppm) was significantly greater ($P < 0.001$) than the mean concentration in eggs collected from the Melton Hill colony ($\bar{x} \pm SE = 0.07 \pm 0.01$, ppm). Therefore, only mercury data from eggs collected from the K25 colony was used in statistical test for differences between on and off ORR mercury concentrations in eggs.

Mean mercury concentration in eggs collected on the ORR was significantly greater than the mean concentration in eggs collected off the ORR (Table F.2). Mean concentrations were greatest in eggs collected from the K25 colony followed in decreasing order in eggs collected from the Long Island ($\bar{x} = 0.12$ ppm) and Looney Island ($\bar{x} = 0.12$ ppm) colonies, and the Melton Hill colony ($\bar{x} = 0.0.07$ ppm).

Mean chromium concentration in eggs collected on the ORR was significantly greater ($P = 0.046$) than the mean concentration in eggs collected off the ORR

(Table F.2). Concentrations were greatest in eggs collected from the Melton Hill colony ($\bar{x}$ = 0.22 ppm) followed in decreasing order by concentrations in the K25 ($\bar{x}$ = 0.15 ppm), Long Island ($\bar{x}$ = 0.11 ppm), and Looney Island ($\bar{x}$ = 0.11 ppm) colonies. Arsenic was quantified in only one egg and the concentration was below the contract required detection limit.

Mean mercury concentrations were significantly greater ($P < 0.05$) in feathers and liver tissue of chicks collected on the ORR compared to those collected off the ORR (Table F.3). Mean feather mercury concentration was significantly greater in chicks collected from the K25 colony ($\bar{x}$ = 2.02 ppm) compared to feathers from chicks collected from the Melton Hill ($\bar{x}$ = 1.02 ppm), Looney Island ($\bar{x}$ = 0.97 ppm), and Long Island ($\bar{x}$ = 0.87 ppm) colonies. Mean liver mercury concentration was not significantly different between chicks collected from the K25 colony ($\bar{x}$ = 0.29 ppm) and the Looney Island colony ($\bar{x}$ = 0.25 ppm). However, mean liver mercury concentration was significantly greater in chicks collected from the K25 colony compared to chicks collected from the Melton Hill ($\bar{x}$ = 0.15 ppm) and Long Island ($\bar{x}$ = 0.12 ppm) colonies. No significant differences existed between muscle liver concentrations between colonies located on or off the ORR. Mean muscle mercury concentration was significantly greater in chicks collected from the K25 colony ($\bar{x}$ = 0.09 ppm) compared to chicks collected from the Melton Hill colony ($\bar{x}$ = 0.05 ppm). No significant differences in mean liver, muscle, or feather concentrations of arsenic or chromium were detected between chick collected on and off ORR, or among colonies (Table F.3).

<u>Egg and Chick PCB and Congener concentrations</u>

Mean concentrations of Aroclor 1260 and 76% of the quantified congeners were significantly greater ($P < 0.05$) in eggs collected from the K25 colony compared to those collected from the Melton Hill colony, while, no significant differences were detected in Aroclor 1260 or congener concentrations between Long Island and Looney Island eggs. Therefore, for statistical analysis between on and off ORR colonies, PCB concentrations in K25 eggs were compared to concentrations in Long Island and Looney Island eggs combined. Mean concentrations of Aroclor 1260 and 10 congeners were significantly greater in eggs collected on the ORR compared to concentrations in eggs collected off the ORR (Table F.4). Concentrations of 47% of the 30 congeners evaluated in egg homogenates were below 30 ppb. Concentrations of congeners 123 and 167 were the only coplanar congeners that differed between eggs from colonies located on and off the ORR.

Aroclor 1260 and a majority of congener concentrations were significantly greater ($P < 0.05$) in fat, liver, and muscle tissue from heron chicks collected from the K25 colony compared to those collected from the Melton Hill colony, while no differences existed between chicks collected from the Long Island and Looney Island colonies. Therefore, comparison of PCB results between on and off ORR was between the K25 colony, and Long Island and Looney Island colonies combined. Aroclor 1260 concentration was significantly greater ($P < 0.05$) in fat, liver, and muscle tissue from chicks collected on the ORR compared to concentrations in chicks collected off the

ORR. Although concentrations of all congeners were greater in fat tissue from chicks collected on the ORR, this difference was significant in only 30% of the congeners quantified (Table F.5). Congener 156 was the only coplanar congener that was significantly different in fat tissue between on and off ORR colonies.

Of the 30 congeners evaluated, 77 and 73% of the concentrations in chick muscle and liver tissue, respectively, were below 30 ppb. In chick liver tissue, concentrations of congeners 110, 118, 151, 153 and 180 differed significantly between on and off ORR colonies (Table F.6). In chick muscle tissue, concentrations of congeners 110, 118, 138, 153, and 180 differed significantly between on and off ORR colonies (Table F.7). Congener 110 and 118 were the only coplanar congener that differed between on and off ORR colonies in liver and muscle tissue, although concentrations of coplanar congeners ranged from below detection to 18 ppm in chick fat tissue.

<u>Physiological and Reproductive Effects</u>

No significant differences were observed in the number of eggs or chicks per nest between on and off ORR colonies (Table F.8). The mean weight of eggs collected from colonies on the ORR were significantly heavier than eggs collected off the ORR, however, there was no difference in shell thickness.

Chick weight/length ratios, liver somatic indexes, and hematocrit measurements were not different in chicks collected on and off the ORR. However, liver EROD activity and DNA F values (fraction of double stranded DNA) were significantly greater ($P < 0.05$) in chicks collected from colonies off the ORR compared to those collected on the ORR (Table F.8).

Although herons occupying the K25 colony have elevated body burdens of mercury and PCBs compared to herons occupying colonies off the ORR, the contaminant levels in tissues do not appear to effect the number of eggs laid or survival of chicks to fledging. Effects on chick survival from fledging to reproductive maturity is yet to be determined. Contaminant data from one adult heron collected on the ORR in August 1992 suggest that body burdens are much greater in adults than in chicks. Mercury concentration in muscle tissue and feathers of this adult were 1.48 and 18.2 ppm, respectively, which is greater than the maximum found in chicks collected during this study (maximum chick muscle Hg = 0.68 ppm; maximum chick feather Hg = 6.35 ppm). Similarly, Aroclor 1260 concentration in muscle tissue of this adult (89 and 38 ppm, respectively) was greater than concentrations detected in chicks (maximum chick muscle Aroclor 1260 = 4.0 ppm). Congener concentrations in this adult also were greater than concentrations found in chicks. Muscle concentrations of coplanar congeners 77, 81, 110, 118, and 123 were 1.0, 2.0, 5.0, 5.0, and 3.8, respectively, which are at least one order of magnitude greater than the maximum concentrations detected in chick muscle tissue (0.07, 0.36, 0.29, 0.21, and 0.15, respectively). This suggests that some individuals may continue to feed on the ORR after fledging, however, it is not know if the chicks that are born on the ORR return to their birth colony to reproduce. Concentrations of mercury and PCBs in eggs collected on the ORR were greater than concentrations in eggs collected off the ORR, which suggest that at least some adults are exposed prior to egg laying. Monitoring movements of chicks after fledging as well as observations for bands placed on chicks during 1993 and 1994 will provide additional data from addressing this issue.

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**Table F.1.** **Mean ±SE (N) concentrations (ppm, wet wt) of elements and Aroclor 1260[1] from homogenized fish[2] collected from great blue heron colonies located on[3] and off[4] the ORR**

| | ON ORR | OFF ORR | P[5] |
|---|---|---|---|
| Mercury | 0.06±0.02 (13) | 0.02±0.00 (15) | 0.030 |
| Arsenic | 0.30±0.05 (13) | 0.23±0.03 (15) | 0.238 |
| Chromium | 1.52±0.54 (12) | 0.37±0.08 (15) | 0.030 |
| Aroclor 1260 | 0.20±0.04 (13) | 0.15±0.03 (15) | 0.269 |

[1]All congeners concentration were <20 ppb.
[2]Various fish species collected from active nest or stomachs of collected great blue heron chicks.
[3]Includes the K25 and Melton Hill colonies.
[4]Includes the Long Island and Looney Island colonies.
[5]T-test P value.

**Table F.2.** **Metal[1] concentrations (ppm, wet wt) detected in great blue heron eggs from colonies located on[2] and off[3] the ORR during 1992-1994**

| | ON ORR | OFF ORR | P[4] |
|---|---|---|---|
| Mercury | | | |
| Mean | 0.17 | 0.12 | 0.009 |
| SE | 0.02 | 0.02 | |
| Min | 0.04 | 0.04 | |
| Max | 0.31 | 0.29 | |
| N | 24 | 34 | |
| Chromium | | | |
| Mean | 0.18 | 0.11 | 0.046 |
| SE | 0.03 | 0.01 | |
| Min | 0.05 | 0.06 | |
| Max | 0.84 | 0.21 | |
| N | 25 | 26 | |

[1]Arsenic was quantified in one egg at a concentration below the contract required detection limit.
[2]Includes K25 colony.
[3]Includes Long Island and Looney Island colonies.
[4]T-test P value.

**Table F.3.** **Metal concentrations (Mean±SE) detected in tissues collected from great blue heron chicks from colonies located on[1] (N=38) and off[2] (N=35) the ORR during 1992-1994**

| | ON ORR | OFF ORR | P[3] |
|---|---|---|---|
| Mercury | | | |
| Feather | 1.71±0.21 | 0.91±0.08 | 0.001 |
| Liver | 0.24±0.03 | 0.16±0.02 | 0.028 |
| Muscle | 0.08±0.01 | 0.09±0.02 | 0.66 |
| Chromium | | | |
| Feather | 0.96±0.17 | 1.16±0.19 | 0.429 |
| Liver | 1.49±0.48 | 1.26±0.49 | 0.739 |
| Muscle | 1.86±0.56 | 2.84±0.81 | 0.322 |
| Arsenic | | | |
| Feather | 0.10±0.01 | 0.10±0.01 | 0.977 |
| Liver | 0.13±0.03 | 0.12±0.02 | 0.771 |
| Muscle | 0.15±0.05 | 0.15±0.04 | 0.938 |

[1]Includes K25 and Melton Hill colonies.
[2]Includes Long Island and Looney Island colonies.
[3]T-test P value.

**Table F.4.** **Mean ±SE (N) Aroclor 1260 and congener concentrations[1] (ppm, wet wt) in great blue heron eggs collected from colonies located on[2] and off[3] the ORR**

| | ON ORR | OFF ORR | P[4] |
|---|---|---|---|
| Aroclor 1260 | 1.68±0.48 (24) | 0.27±0.08 (34) | 0.008 |
| CB 81 | 0.13±0.04 (16) | 0.08±0.02 (26) | 0.365 |
| CB 99 | 0.09±0.03 (16) | 0.02±0.01 (26) | 0.030 |
| CB 101 | 0.04±0.02 (16) | 0.00±0.00 (26) | 0.018 |
| CB 118 | 0.17±0.04 (16) | 0.08±0.02 (26) | 0.062 |
| CB 123 | 0.11±0.04 (16) | 0.01±0.00 (26) | 0.015 |
| CB 138 | 0.29±0.05 (16) | 0.14±0.03 (26) | 0.025 |
| CB 146 | 0.09±0.03 (16) | 0.03±0.01 (26) | 0.036 |
| CB 149 | 0.09±0.05 (8) | 0.03±0.01 (14) | 0.288 |
| CB 153 | 0.37±0.07 (16) | 0.16±0.04 (26) | 0.019 |
| CB 158 | 0.04±0.02 (16) | 0.06±0.02 (26) | 0.128 |
| CB 167 | 0.05±0.01 (16) | 0.01±0.00 (26) | 0.008 |
| CB 170 | 0.09±0.02 (16) | 0.04±0.01 (26) | 0.012 |
| CB 180 | 0.27±0.06 (16) | 0.11±0.02 (26) | 0.021 |
| CB 183 | 0.06±0.01 (16) | 0.02±0.00 (26) | 0.020 |
| CB 194 | 0.04±0.01 (16) | 0.02±0.00 (26) | 0.076 |
| CB 196 | 0.07±0.02 (16) | 0.03±0.01 (26) | 0.059 |

[1]Concentrations of CBs 66, 76, 77, 95, 105, 110, 114, 126, 128, 132, 151, 156, 171, and 201 were <30 ppb and are not included.
[2]Includes the K25 colony.
[3]Includes the Long Island and Looney Island colonies.
[4]T-test P value.

**Table F.5.** **Mean ±SE (N) Aroclor 1260 and congener concentrations (ppm, wet wt) in abdominal fat from great blue heron chicks collected from colonies located on[1] and off[2] the ORR**

| | ON ORR | OFF ORR | P[3] |
|---|---|---|---|
| Aroclor 1260 | 48.63±11.71 (16) | 15.70±2.64 (24) | 0.014 |
| CB 66 | 1.21±0.75 (16) | 0.23±0.03 (24) | 0.210 |
| CB 76 | 0.78±0.55 (16) | 0.12±0.02 (24) | 0.250 |
| CB 77 | 0.27± 0.10 (16) | 0.20±0.04 (24) | 0.556 |
| CB 81 | 1.54±0.44 (16) | 1.28±0.30 (24) | 0.761 |
| CB 95 | 0.84±0.54 (16) | 0.14±0.04 (24) | 0.216 |
| CB 99 | 2.70±1.36 (16) | 0.56±0.15 (24) | 0.138 |
| CB 101 | 2.65±1.37 (16) | 0.47±0.15 (24) | 0.134 |
| CB 105 | 0.73±0.36 (16) | 0.13±0.02 (24) | 0.115 |
| CB 110 | 2.40±1.16 (16) | 0.49±0.10 (24) | 0.122 |
| CB 114 | 0.07±0.04 (16) | 0.00±0.00 (24) | 0.999 |
| CB 118 | 1.95±0.82 (16) | 0.79±0.11 (24) | 0.182 |
| CB 123 | 2.53±1.09 (16) | 0.63±0.11 (24) | 0.102 |
| CB 126 | 0.54±0.13 (16) | 0.33±0.08 (24) | 0.195 |
| CB 128 | 0.95±0.37 (16) | 0.19±0.02 (24) | 0.058 |
| CB 132 | 0.76±0.41 (16) | 0.14±0.02 (24) | 0.146 |
| CB 138 | 5.13±1.44 (16) | 1.70±0.23 (24) | 0.032 |
| CB 146 | 1.70±0.37 (16) | 0.75±0.11 (24) | 0.024 |
| CB 149 | 2.76±0.54 (7) | 1.04±0.24 (12) | 0.018 |
| CB 151 | 0.98±0.35 (16) | 0.33±0.06 (24) | 0.084 |
| CB 153 | 6.24±1.35 (16) | 2.47±0.45 (24) | 0.016 |
| CB 156 | 0.31±0.09 (16) | 0.12±0.02 (24) | 0.043 |

| | | | |
|---|---|---|---|
| CB 158 | 0.19±0.14 (16) | 0.21±0.08 (24) | 0.905 |

Table F.5.
Continued

| | ON ORR | OFF ORR | P[3] |
|---|---|---|---|
| CB 167 | 0.86±0.30 (16) | 0.29±0.04 (24) | 0.078 |
| CB 170 | 1.57±0.34 (16) | 0.54±0.07 (24) | 0.010 |
| CB 171 | 0.22±0.09 (16) | 0.17±0.05 (24) | 0.621 |
| CB 180 | 4.27±0.95 (16) | 1.37±0.25 (24) | 0.009 |
| CB 183 | 0.88±0.25 (16) | 0.35±0.05 (24) | 0.054 |
| CB 194 | 0.63±0.12 (16) | 0.38±0.05 (31) | 0.078 |
| CB 196 | 0.93±0.21 (16) | 0.37±0.06 (24) | 0.018 |
| CB 201 | 0.53±0.11 (16) | 0.22±0.03 (24) | 0.012 |

[1]Includes the K25 colony.
[2]Includes the Long Island and Looney Island colonies.
[3]T-test P value.

**Table F.6.** **Mean ±SE (N) Aroclor 1260 and congener concentrations[1] (ppm, wet wt) in liver tissue from great blue heron chicks collected from colonies located on[2] and off[3] the ORR**

| | ON ORR | OFF ORR | P[4] |
|---|---|---|---|
| Aroclor 1260 | 0.77±0.23 (18) | 0.23±0.03 (22) | 0.029 |
| CB 110 | 0.06±0.02 (18) | 0.02±0.00 (22) | 0.050 |
| CB 118 | 0.05±0.02 (18) | 0.01±0.00 (22) | 0.049 |
| CB 138 | 0.07±0.03 (18) | 0.02±0.00 (22) | 0.077 |
| CB 149 | 0.06±0.03 (8) | 0.02±0.00 (10) | 0.209 |
| CB 151 | 0.04±0.02 (18) | 0.01±0.00 (22) | 0.048 |
| CB 153 | 0.10±0.03 (18) | 0.03±0.00 (22) | 0.017 |
| CB 180 | 0.07±0.02 (18) | 0.02±0.00 (22) | 0.021 |

[1]Concentrations of CBs 66, 76, 77, 95, 99, 101, 105, 114, 123, 126, 128, 132, 146, 156, 158, 167, 170, 171, 183, 194, 196, and 201 were <30 ppb and are not included.

[2]Includes the K25 colony.

[3]Includes the Long Island and Looney Island colonies.

[4]T-test P value.

**Table F.7.** **Mean ±SE (N) Aroclor 1260 and congener concentrations[1] (ppm, wet wt) in muscle tissue from great blue heron chicks collected from colonies located on[2] and off[3] the ORR**

| | ON ORR | OFF ORR | P[4] |
|---|---|---|---|
| Aroclor 1260 | 1.05±0.25 (18) | 0.35±0.08 (24) | 0.015 |
| CB 81 | 0.04±0.01 (18) | 0.04±0.02 (24) | 0.795 |
| CB 110 | 0.06±0.02 (18) | 0.01±0.00 (24) | 0.027 |
| CB 118 | 0.06±0.01 (18) | 0.02±0.01 (24) | 0.015 |
| CB 138 | 0.09±0.02 (18) | 0.04±0.01 (24) | 0.033 |
| CB 149 | 0.09±0.03 (8) | 0.03±0.01 (12) | 0.086 |
| CB 153 | 0.16±0.03 (18) | 0.05±0.01 (24) | 0.009 |
| CB 180 | 0.10±0.02 (18) | 0.03±0.01 (24) | 0.008 |

[1]Concentrations of CBs 66, 76, 77, 95, 99, 101, 105, 114, 123, 126, 128, 132, 146, 151, 156, 167, 170, 171, 183, 194, 196, and 201 were <30 ppb and are not included.
[2]Includes the K25 colony.
[3]Includes the Long Island and Looney Island colonies.
[4]T-test P value, based on lipid adjusted concentrations.

**Table F.8. Reproductive, physiological, and biomarker measurements [Mean±SE (N)] in great blue heron from colonies located on[1] and off[2] the ORR during 1992-1994**

| | ON ORR | OFF ORR |
|---|---|---|
| Mean eggs/nest | 3.5±0.2 (26) | 3.2±0.2 (27) |
| Egg shell thickness (mm) | 0.427±0.01 (33) | 0.410±0.01 (34) |
| Egg weight (g)[3] | 69.16±0.97 (33) | 66.36±0.97 (34) |
| Mean chicks/nest | 2.7±0.1 (55) | 2.7±0.2 (30) |
| Chick weight/length ratio | 2.06±0.05 (38) | 2.12±0.06 (35) |
| Liver somatic index | 4.50±0.16 (38) | 4.64±0.23 (35) |
| Liver EROD activity[4] | 31.9±2.7 (12) | 41.3±3.2 (12) |
| DNA double-strandedness (F)[5] | 73±0.03 (26) | 84±0.02 (27) |
| Hematocuit | 32±0.8 (38) | 31±0.7 (26) |

[1]Includes K25 and Melton Hill colonies.
[2]Includes Long Island and Looney Island colonies.
[3]Means significantly different (T-test, P=0.048).
[4]1994 data; ethoxyresorufin-o-deethylase activity (pmole/mq protein/min); means significantly different (T-test, P=0.033).
[5]Means signficantly different (T-test, P=0.006), F = fraction of double-stranded DNA.

# Appendix G

# TABLES AND FIGURES FOR CHAPTER 5: ASSESSMENT OF RISK TO VERMIVORES AND HERBIVORES ON THE OAK RIDGE RESERVATION

**Table G.1. Life history parameters for the white-tailed deer (*Odocoileus virginianus*)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Body weight | 68 kg (♂)<br>45 kg (♀)<br>**56.5** kg (mean♂+♀) | | Smith 1991 |
| Food consumption rate | **1.74** kg/d | | Mautz et al. 1976 |
| Water consumption rate | **3.7** L/d | estimated using allometric equation[b] assuming 56.5 kg bw | |
| Soil consumption rate | <2% | | Beyer et al. 1994 |
| | **0.0348** kg/d | assuming 2% soil and 1.74 kg/d food consumption rates | |
| Diet composition | exclusively herbivorous | | |
| | diet diverse and variable, depends on availability. | | Zim et al. 1951 |
| | major foods:<br>- buds and twigs of trees and shrubs<br>- grasses and forbs (summer)<br>- mast and fruits (fall) | | Smith 1991 |
| Home range | 59 - 520 ha | | Marchinton and Hirth 1984 |
| Habitat requirements | uses a wide variety of habitats; favors forest-field-farmland mosaic; population density directly related to number and distribution of forest openings | | Smith 1991 |
| Population density | 0.06 /ha | eastern mixed deciduous forest - Tennessee | Barber 1984 |
| | 0.39 - 0.78 /ha | oak-hickory forest - midwest | Torgerson and Porath 1984 |
| | **0.1704**/ha (calculated based on 2000 deer on ORR and available habitat) | Oak Ridge Reservation | personal communication, Jim Evans 1995 |

**Table G.1 (continued)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Behavior | generally crepuscular | | Smith 1991 |
| | active year-round; does not hibernate | | |

[a] Suggested values for use in exposure assessment are in bold.

[b] Allometric equation for estimation of water consumption for deer is:

$$WIR = 0.099(BW)^{0.90}$$

where:

WIR = water ingestion rate (L water/individual/day).

**Table G.2. Life history parameters for the wild turkey (*Meleagris gallopavo*)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Body weight | 7.400 kg (♂)<br>4.222 kg (♀)<br><br>**5.8** kg (mean♂+♀) | | Dunning 1984 |
| Food consumption rate | 13.6 g/lb bw/d<br><br>**0.174** kg/d | <br><br>assuming 5.8 kg bw | Korschgen 1967 |
| Water consumption rate | **0.19** L/d | estimated using allometric equation[c] assuming 5.8 kg bw | |
| Soil consumption rate | 9.3 %<br><br>**0.0162** kg/d | <br><br>assuming 0.174 kg/d food consumption rates | Beyer et al. 1994 |
| Diet composition | plant material (mast, fruit, seeds, some foliage) - 90.3%<br><br>animal material (insects, crayfish, snails, salamanders) - 9.7 % | | Korschgen 1967 |
| Home range | 150 - 190 ha | | Pough 1951[b] |
| Habitat requirements | mast-producing woodlands with associated fields and abundant water | | Schorger 1966[b] |
| Population density | 0.03 /ha<br><br>0.06 - 0.076 /ha<br><br>**0.0426** /ha (calculated based on @ 500 turkey observed on ORR and suitable habitat) | West Virginia<br><br>in 'ideal' habitat<br><br>Oak Ridge Reservation | Uhling 1950[b]<br><br>Pough 1951[b]<br><br>Personal Communication, Jim Evans 1995 |
| Behavior | forage primarily on the ground<br><br>roost in trees at night<br><br>year-round resident; does not migrate | | National Geographic Society 1987 |

**Table G.2 (continued)**

[a] Suggested values for use in exposure assessment are in bold.

[b] Cited in DeGraaf et al. 1981.

[c] Allometric equation for estimation of water consumption for birds is:

$$WIR = 0.059(BW)^{0.67}$$

where:

WIR = water ingestion rate (L water/individual/day).

**Table G.3. Life history parameters for the short-tailed shrew (*Blarina brevicauda*)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Body weight | **0.015** ± 0.00078 kg | New Hampshire (field) | Schlessinger and Potter 1974 |
| Food consumption rate | 0.01 kg/d | larch sawfly diet (lab) | Buckner 1964 |
| | 0.00795 ± 0.00017 kg/d | mealworm diet (lab) | Barrett and Stueck 1976 |
| | mean = **0.009** kg/d | | |
| Water consumption rate | 0.223 ml/g bw/d | | Chew 1951 |
| | **0.033** L/d | assuming a 0.015 kg bw | |
| Soil consumption rate | 13% of diet | | Talmage and Walton 1993 |
| | **0.00117** kg/d | assuming diet of 0.009 kg/d | |
| Diet composition | earthworms 31.4%<br>slugs/snails 27.1%<br>soil/litter invert 13.2%<br>fungi 8.4%<br>misc. animals 8.1%<br>coleoptera 5.9%<br>vegetation 5.4% | percent volume in diet in summer in New York | Whitaker and Ferraro 1963 |
| Home range | **0.39** ± 0.036 ha | Manitoba bog | Buckner 1966 |
| Habitat requirements | broad and variable but requires >50% herbaceous cover | | Miller and Getz 1977 |
| | forest, wetlands, and grasslands. most abundant in hardwood forests with deep litter and humus. | | van Zyll de Jong 1983 |

**Table G.3 (continued)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Population density | 2.3 /ha - winter<br>5.2 /ha - spring<br>9.3 /ha -summer<br>8.1 /ha - fall | Illinois - alfalfa, tallgrass, and bluegrass;<br>means derived from graph. | Getz 1989 |
| | 2.5-45 /ha<br>(median= **23 /ha**) | range depending on the habitat | |
| Behavior | nocturnal, semifossorial, spends little time above surface | | George et al. 1986 |
| | active year-round - does not hibernate | | EPA 1993a |
| Other | appear to be unpalatable to most predators due to lateral gland | | van Zyll de Jong 1983 |

[a] Suggested values for use in exposure assessment are in bold.

**Table G.4. Life history parameters for the American woodcock (*Scolopax minor*)**

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Body weight | 0.176 kg (♂)<br>0.219 kg (♀)<br><br>**0.198** kg (mean♂+♀) | | Dunning 1984 |
| Food consumption rate | **0.15** kg/d | | Sheldon 1971 |
| Water consumption rate | **0.02** L/d | estimated using allometric equation[b] assuming 0.198 kg bw | |
| Soil consumption rate | 10.4%<br><br>**0.0156** kg/d | <br><br>assuming diet of 0.15 kg/d | Beyer et al. 1994 |
| Diet composition | primarily earthworms (58 % - ~99 %)<br><br>plus other ground-dwelling invertebrates | | Sperry 1940<br>Krohn 1970<br>Miller and Causey 1985<br>Stribling and Doerr 1985 |
| Home range | 10.5 ha (singing ♂)<br>73.6 ha (active ♂)<br>3.1 ha (inactive ♂) | Pennsylvania - mixed forest fields | Hudgins et al. 1985 |
| Habitat requirements | Breeding: moist early successional woodlands, swamps, river bottoms, alder thickets<br><br>feeding: moist open pasture, cultivated fields, stream banks | | DeGraaf et al. 1981 |
| Population density | <br>3.4 /ha<br>0.2 /ha<br>0.034 /ha | North Carolina - winter<br>untilled soy stubble<br>untilled corn stubble<br>rebedded corn | Connors and Doerr 1982 |
| | 0.21 nests/ha | Pennsylvania - mixed pine hardwoods | Coon et al. 1982 |
| | **0.28** /ha | based on 5.6 males/40 ha; assuming 1:1 sex ration | Stewart and Robbins 1958 |

Table G.4 (continued)

| Parameter | Value[a] | Comments | Reference |
|---|---|---|---|
| Behavior | migrate from northern breeding range to wintering range in south Atlantic and gulf coast states. | | Sheldon 1971 |
| | early migrants; leave wintering grounds in February, arrive at northern breeding grounds lat March. | | |

[a] Suggested values for use in exposure assessment are in bold.

[b] Allometric equation for estimation of water consumption for birds is:

$$WIR = 0.059(BW)^{0.67}$$

where:

WIR= water ingestion rate (L water/individual/day).

**Table G.5. Contaminant concentrations in soil (mg/kg) on the ORR**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BCVOU1 | 1,1,1-trichlorethane | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA[b] |
| BCVOU1 | 1,1,2,2-Tetrachloroethane | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | 1,1-Dichlorethene | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | 1,2-Dichlorethane | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | 1,2-Dichlorethene | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | 4,4-DDD | 20 | 0 | 20 | 0.1083 | NA | 0.0038 | 0.48 | NA |
| BCVOU1 | 4,4-DDE | 20 | 1 | 19 | 0.1081 | 0.0390 | 0.0009 | 0.48 | NA |
| BCVOU1 | 4,4-DDT | 20 | 1 | 19 | 0.1081 | 0.0390 | 0.001 | 0.48 | NA |
| BCVOU1 | Acetone | 22 | 14 | 8 | 0.0361 | 0.0075 | 0.012 | 0.17 | 0.0432 |
| BCVOU1 | Aldrin | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | Aluminum | 13 | 13 | 0 | 12636.1538 | 1233.5552 | 7660 | 23100 | 14834.7 |
| BCVOU1 | Antimony | 13 | 8 | 5 | 1.0308 | 0.3807 | 0.21 | 4.4 | 1.7371 |
| BCVOU1 | Arsenic | 13 | 13 | 0 | 9.2692 | 2.2909 | 1.1 | 28.8 | 13.3522 |
| BCVOU1 | Barium | 13 | 13 | 0 | 264.3154 | 77.8175 | 63.2 | 1100 | 403.009 |
| BCVOU1 | Benzene | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | Benzo(a)Pyrene | 20 | 12 | 8 | 10.8110 | 5.0073 | 0.39 | 76 | 19.9008 |
| BCVOU1 | Beryllium | 13 | 13 | 0 | 1.0508 | 0.2118 | 0.42 | 3.3 | 1.4283 |
| BCVOU1 | Bis(2-ethylhexyl) phthalate | 20 | 11 | 9 | 3.3329 | 2.1316 | 0.051 | 43 | 0.5873 |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BCVOU1 | Cadmium | 13 | 6 | 7 | 5.3800 | 2.4685 | 0.33 | 31.3 | 10.7364 |
| BCVOU1 | Carbon tetrachloride | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | Chloroform | 22 | 1 | 21 | 0.0116 | 0.0021 | 0.001 | 0.032 | NA |
| BCVOU1 | Chromium | 13 | 13 | 0 | 48.9769 | 10.8778 | 15.9 | 140 | 68.3643 |
| BCVOU1 | Copper | 13 | 13 | 0 | 972.0615 | 453.3139 | 7.8 | 5210 | 1779.9973 |
| BCVOU1 | Cyanide | 13 | 0 | 13 | 0.6838 | NA | 0.6 | 0.99 | NA |
| BCVOU1 | Di-n-butylPhthalate | 20 | 16 | 4 | 2.9991 | 2.1474 | 0.061 | 43 | 0.3164 |
| BCVOU1 | Dibenzofuran | 20 | 10 | 10 | 1.3689 | 0.5334 | 0.068 | 10 | 2.1155 |
| BCVOU1 | Dieldrin | 20 | 0 | 20 | 0.1083 | NA | 0.0038 | 0.48 | NA |
| BCVOU1 | DiethylPhthalate | 20 | 0 | 20 | 3.3570 | NA | 0.39 | 43 | NA |
| BCVOU1 | Endosulfan I | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | Endosulfan II | 20 | 0 | 20 | 0.1083 | NA | 0.0038 | 0.48 | NA |
| BCVOU1 | Endrin | 20 | 0 | 20 | 0.1083 | NA | 0.0038 | 0.48 | NA |
| BCVOU1 | HePtachlor | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | Lead | 13 | 13 | 0 | 287.4615 | 143.5150 | 9.7 | 1870 | 543.2465 |
| BCVOU1 | Lindane | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | Manganese | 13 | 13 | 0 | 910.1000 | 141.5051 | 79.3 | 1690 | 1162.3027 |
| BCVOU1 | Mercury | 13 | 12 | 1 | 18.9815 | 7.1889 | 0.06 | 77.7 | 31.8423 |
| BCVOU1 | Methoxychlor | 20 | 0 | 20 | 0.5431 | NA | 0.019 | 2.4 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BCVOU1 | Methylene chloride | 22 | 22 | 0 | 0.0175 | 0.0034 | 0.004 | 0.05 | 0.0233 |
| BCVOU1 | Molybdenum | 13 | 6 | 7 | 8.8554 | 4.0350 | 0.57 | 44.9 | 18.2024 |
| BCVOU1 | Nickel | 13 | 13 | 0 | 85.1077 | 29.4124 | 8.3 | 339 | 137.5290 |
| BCVOU1 | PCB-1016 | 20 | 0 | 20 | 1.0827 | NA | 0.038 | 4.8 | NA |
| BCVOU1 | PCB-1242 | 20 | 0 | 20 | 1.0827 | NA | 0.038 | 4.8 | NA |
| BCVOU1 | PCB-1248 | 20 | 0 | 20 | 1.0827 | NA | 0.038 | 4.8 | NA |
| BCVOU1 | PCB-1254 | 20 | 13 | 7 | 1.7904 | 0.6140 | 0.022 | 10 | 2.6646 |
| BCVOU1 | PCB-1260 | 20 | 6 | 14 | 3.6508 | 1.8962 | 0.038 | 36 | 6.7408 |
| BCVOU1 | Pentachlorophenol | 20 | 0 | 20 | 8.5035 | NA | 0.97 | 110 | NA |
| BCVOU1 | Selenium | 13 | 11 | 2 | 1.7500 | 0.2889 | 0.6 | 4.1 | 2.2682 |
| BCVOU1 | Tetrachlorothene | 22 | 1 | 21 | 0.0117 | 0.0021 | 0.003 | 0.032 | NA |
| BCVOU1 | Thallium | 13 | 0 | 13 | 0.4531 | NA | 0.4 | 0.7 | NA |
| BCVOU1 | Tin | 13 | 8 | 5 | 20.5231 | 7.3485 | 2.4 | 88.4 | 34.4281 |
| BCVOU1 | Toluene | 22 | 22 | 0 | 0.3137 | 0.0497 | 0.021 | 0.7 | 0.3992 |
| BCVOU1 | Toxaphene | 20 | 0 | 20 | 5.4305 | NA | 0.19 | 24 | NA |
| BCVOU1 | Trichloroethene | 22 | 0 | 22 | 0.0119 | NA | 0.006 | 0.032 | NA |
| BCVOU1 | Vanadium | 13 | 13 | 0 | 26.9462 | 2.7098 | 15 | 50.4 | 31.7758 |
| BCVOU1 | Vinyl chloride | 22 | 0 | 22 | 0.0240 | NA | 0.012 | 0.065 | NA |
| BCVOU1 | Zinc | 13 | 13 | 0 | 668.9077 | 260.5632 | 27.1 | 2850 | 1133.3062 |

Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BCVOU1 | Alpha-BHC | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | alpha-chlordane | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | beta-BHC | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | Delta-BHC | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| BCVOU1 | gamma-chlordane | 20 | 0 | 20 | 0.0543 | NA | 0.0019 | 0.24 | NA |
| LEFPC | 1,1,1-trichlorethane | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | 1,1-Dichlorethene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | 1,2-Dichlorethane | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | 1,2-Dichlorethene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | 4,4-DDD | 115 | 6 | 109 | 0.0166 | 0.0023 | 0.0001 | 0.22 | 0.0006 |
| LEFPC | 4,4-DDE | 114 | 36 | 78 | 0.0154 | 0.0023 | 0.0002 | 0.22 | 0.00228 |
| LEFPC | 4,4-DDT | 115 | 5 | 110 | 0.0168 | 0.0023 | 0.0002 | 0.22 | 0.0014 |
| LEFPC | Acetone | 12 | 12 | 0 | 0.2536 | 0.1800 | 0.003 | 2.2 | 0.5768 |
| LEFPC | Aldrin | 115 | 11 | 104 | 0.0083 | 0.0012 | 8e-05 | 0.11 | 0.0004 |
| LEFPC | Aluminum | 150 | 150 | 0 | 12605.6667 | 377.0456 | 0 | 27900 | 13229.731 |
| LEFPC | Antimony | 1590 | 1316 | 274 | 1.2837 | 0.0656 | 0.13 | 53.9 | 0.7872 |
| LEFPC | Arsenic | 1289 | 1275 | 14 | 7.7788 | 0.1166 | 1.1 | 77.3 | 7.9621 |
| LEFPC | Barium | 150 | 150 | 0 | 121.3567 | 5.2507 | 33.7 | 454 | 130.0473 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| LEFPC | Benzene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Benzo(a)Pyrene | 113 | 70 | 43 | 0.4917 | 0.0476 | 0.05 | 3.5 | 0.4838 |
| LEFPC | Beryllium | 150 | 146 | 4 | 0.9165 | 0.0383 | 0.25 | 4.6 | 0.9781 |
| LEFPC | Bis(2-ethylhexyl)Phthalate | 113 | 62 | 51 | 0.3343 | 0.0229 | 0.045 | 1.3 | 0.2007 |
| LEFPC | Cadmium | 150 | 100 | 50 | 4.0894 | 0.3975 | 0.73 | 41.3 | 4.6446 |
| LEFPC | Carbon tetrachloride | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Chloroform | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Chromium | 1698 | 1698 | 0 | 64.6076 | 0.5609 | 6.9 | 217 | 65.5307 |
| LEFPC | Copper | 150 | 150 | 0 | 78.0333 | 7.0314 | 2.6 | 397 | 89.6714 |
| LEFPC | Cyanide | 36 | 22 | 14 | 3.0242 | 1.7695 | 0 | 62.6 | 5.8240 |
| LEFPC | Di-n-butlyPhthalate | 113 | 33 | 80 | 0.4212 | 0.0190 | 0.045 | 1.3 | 0.1841 |
| LEFPC | Dibenzofuran | 113 | 9 | 104 | 0.4390 | 0.0158 | 0.052 | 1.3 | 0.1178 |
| LEFPC | Dieldrin | 115 | 9 | 106 | 0.0169 | 0.0023 | 0.0002 | 0.22 | 0.0015 |
| LEFPC | DiethylPhthalate | 113 | 2 | 111 | 0.4612 | 0.0134 | 0.16 | 1.3 | 0.1733 |
| LEFPC | Endosulfan I | 115 | 3 | 112 | 0.0084 | 0.0012 | 0.0001 | 0.11 | 0.0009 |
| LEFPC | Endosulfan II | 115 | 5 | 110 | 0.0167 | 0.0023 | 0.0003 | 0.22 | 0.0010 |
| LEFPC | Endrin | 115 | 9 | 106 | 0.0166 | 0.0023 | 0.0001 | 0.22 | 0.0007 |
| LEFPC | Heptachlor | 115 | 19 | 96 | 0.0081 | 0.0012 | 8e-05 | 0.11 | 0.0002 |
| LEFPC | Lead | 148 | 148 | 0 | 53.7993 | 4.6434 | 5.2 | 625 | 61.4855 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| LEFPC | Lindane | 115 | 4 | 111 | 0.0085 | 0.0012 | 0.0002 | 0.11 | 0.0007 |
| LEFPC | Manganese | 150 | 150 | 0 | 1110.0367 | 51.1151 | 25.6 | 4270 | 1194.6395 |
| LEFPC | Mercury | 1720 | 589 | 1131 | 38.4880 | 3.0932 | 0.11 | 1870 | 41.6088 |
| LEFPC | Methoxychlor | 115 | 12 | 103 | 0.0835 | 0.0117 | 0.0003 | 1.1 | 0.0059 |
| LEFPC | Methylene chloride | 12 | 12 | 0 | 0.0373 | 0.0087 | 0.01 | 0.11 | 0.0529 |
| LEFPC | Nickel | 150 | 146 | 4 | 34.3673 | 2.1702 | 3.7 | 174 | 37.9061 |
| LEFPC | PCB-1016 | 146 | 9 | 137 | 0.0896 | 0.0092 | 0.033 | 1.1 | 0.0499 |
| LEFPC | PCB-1221 | 146 | 9 | 137 | 0.1201 | 0.0098 | 0.067 | 1.1 | 0.1005 |
| LEFPC | PCB-1232 | 146 | 9 | 137 | 0.0896 | 0.0092 | 0.033 | 1.1 | 0.0499 |
| LEFPC | PCB-1242 | 146 | 9 | 137 | 0.0896 | 0.0092 | 0.033 | 1.1 | 0.0499 |
| LEFPC | PCB-1248 | 146 | 9 | 137 | 0.0896 | 0.0092 | 0.033 | 1.1 | 0.0499 |
| LEFPC | PCB-1254 | 146 | 23 | 123 | 0.2579 | 0.0412 | 0.033 | 3 | 0.2239 |
| LEFPC | PCB-1260 | 145 | 91 | 54 | 0.4311 | 0.0587 | 0.003 | 3.8 | 0.4655 |
| LEFPC | Pentachlorophenol | 113 | 2 | 111 | 1.6920 | 0.0927 | 0.067 | 6.4 | 0.3767 |
| LEFPC | Selenium | 1716 | 439 | 1277 | 13.5663 | 0.2453 | 0.61 | 110 | 8.7045 |
| LEFPC | Tetrachloroethene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Thallium | 146 | 1 | 145 | 0.8092 | 0.1281 | 0.43 | 19.3 | NA |
| LEFPC | Toluene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Toxaphene | 115 | 0 | 115 | 0.2729 | NA | 0.18 | 2.2 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| LEFPC | Trichloroethene | 12 | 0 | 12 | 0.0090 | NA | 0.006 | 0.02 | NA |
| LEFPC | Uranium | 24 | 24 | 0 | 9.7083 | 1.2757 | 1.98 | 25.59 | 11.8948 |
| LEFPC | Vanadium | 150 | 150 | 0 | 26.8927 | 0.8537 | 9.6 | 92.7 | 28.3057 |
| LEFPC | Vinyl chloride | 12 | 0 | 12 | 0.0182 | NA | 0.012 | 0.04 | NA |
| LEFPC | Zinc | 1701 | 521 | 1180 | 179.9126 | 15.5480 | 14 | 7640 | 166.1992 |
| LEFPC | Alpha-BHC | 115 | 0 | 115 | 0.0085 | NA | 0.0018 | 0.11 | NA |
| LEFPC | Alpha-chlordane | 115 | 39 | 76 | 0.0730 | 0.0121 | 0.0001 | 1.1 | 0.0025 |
| LEFPC | Beta-BHC | 115 | 0 | 115 | 0.0085 | NA | 0.0018 | 0.11 | NA |
| LEFPC | Delta-BHC | 115 | 5 | 110 | 0.0084 | 0.0012 | 6e-05 | 0.11 | 0.0003 |
| LEFPC | Gamma-chlordane | 115 | 33 | 82 | 0.0727 | 0.0121 | 8e-05 | 1.1 | 0.0014 |
| K-1407 OU | 1,1,1-trichlorethane | 37 | 1 | 36 | 0.0155 | 0.0005 | 0.001 | 0.02 | NA |
| K-1407 OU | 1,1-Dichlorethene | 37 | 0 | 37 | 0.0159 | NA | 0.012 | 0.02 | NA |
| K-1407 OU | 1,2-Dichlorethane | 37 | 0 | 37 | 0.0159 | NA | 0.012 | 0.02 | NA |
| K-1407 OU | 1,2-Dichlorethene | 37 | 3 | 34 | 0.0171 | 0.0007 | 0.012 | 0.033 | 0.0277 |
| K-1407 OU | Acetone | 37 | 11 | 26 | 0.0285 | 0.0015 | 0.008 | 0.042 | 0.0188 |
| K-1407 OU | Aluminum | 81 | 81 | 0 | 26562.9630 | 1298.3185 | 7600 | 69000 | 28723.527 |
| K-1407 OU | Antimony | 81 | 1 | 80 | 7.1506 | 0.7359 | 4.8 | 50 | NA |
| K-1407 OU | Arsenic | 81 | 35 | 46 | 12.4333 | 1.1038 | 5 | 50 | 13.0681 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1407 OU | Barium | 81 | 81 | 0 | 110.4938 | 8.8823 | 25 | 600 | 125.2752 |
| K-1407 OU | Benzene | 37 | 0 | 37 | 0.0159 | NA | 0.012 | 0.02 | NA |
| K-1407 OU | Beryllium | 81 | 81 | 0 | 1.0159 | 0.0667 | 0.25 | 4.9 | 1.1269 |
| K-1407 OU | Boron | 81 | 38 | 43 | 6.4191 | 1.1358 | 0.4 | 59 | 8.3996 |
| K-1407 OU | Cadmium | 81 | 70 | 11 | 1.8799 | 0.1743 | 0.3 | 8.5 | 2.1492 |
| K-1407 OU | Carbon tetrachloride | 37 | 0 | 37 | 0.0159 | NA | 0.012 | 0.02 | NA |
| K-1407 OU | Chloroform | 37 | 4 | 33 | 0.0156 | 0.0004 | 0.006 | 0.024 | 0.0119 |
| K-1407 OU | Chromium | 81 | 81 | 0 | 61.0370 | 5.3044 | 18 | 240 | 69.8642 |
| K-1407 OU | Copper | 81 | 79 | 2 | 40.8537 | 4.6847 | 0.51 | 190 | 48.6398 |
| K-1407 OU | Di-n-butylphthalate | 6 | 6 | 0 | 0.0172 | 0.0007 | 0.016 | 0.02 | 0.0185 |
| K-1407 OU | Lead | 81 | 78 | 3 | 30.6753 | 1.5668 | 5.8 | 72 | 32.9964 |
| K-1407 OU | Manganese | 81 | 81 | 0 | 1184.7778 | 102.4519 | 86 | 3900 | 1355.2705 |
| K-1407 OU | Mercury | 64 | 28 | 36 | 4.7250 | 0.9668 | 1 | 40 | 6.3965 |
| K-1407 OU | Methylene chloride | 37 | 37 | 0 | 0.0175 | 0.0022 | 0.003 | 0.036 | 0.0212 |
| K-1407 OU | Molybdenum | 81 | 28 | 53 | 1.8006 | 0.1551 | 0.96 | 10 | 1.5498 |
| K-1407 OU | Nickel | 81 | 81 | 0 | 192.1790 | 35.4005 | 5 | 1500 | 251.0899 |
| K-1407 OU | Selenium | 81 | 1 | 80 | 7.1519 | 0.7359 | 4.8 | 50 | NA |
| K-1407 OU | Strontium | 81 | 81 | 0 | 18.1420 | 1.5188 | 1.8 | 64 | 20.6695 |
| K-1407 OU | Tetrachloroethene | 37 | 8 | 29 | 0.0232 | 0.0046 | 0.005 | 0.17 | 0.0243 |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1407 OU | Toluene | 37 | 11 | 26 | 0.0115 | 0.0012 | 0.0009 | 0.02 | 0.0010 |
| K-1407 OU | Trichloroethene | 37 | 11 | 26 | 0.0246 | 0.0040 | 0.009 | 0.13 | 0.0281 |
| K-1407 OU | Uranium | 386 | 353 | 33 | 143.6944 | 68.1672 | 0.108 | 26190 | 255.8501 |
| K-1407 OU | Vanadium | 81 | 81 | 0 | 38.9753 | 1.4213 | 14 | 75 | 41.3405 |
| K-1407 OU | Vinyl chloride | 37 | 0 | 37 | 0.0317 | NA | 0.025 | 0.04 | NA |
| K-1407 OU | Zinc | 81 | 81 | 0 | 59.7778 | 2.8203 | 11 | 140 | 64.4711 |
| | | | | | | | | | |
| WAG 1 | 1,1,1-trichlorethane | 168 | 12 | 156 | 0.0077 | 0.0005 | 0.002 | 0.034 | 0.0033 |
| WAG 1 | 1,1-Dichlorethene | 168 | 2 | 166 | 0.0076 | 0.0004 | 0.005 | 0.034 | 0.0060 |
| WAG 1 | 1,2-Dichlorethane | 168 | 2 | 166 | 0.0076 | 0.0004 | 0.005 | 0.034 | 0.0060 |
| WAG 1 | 1,2-Dichlorethene | 168 | 4 | 164 | 0.0076 | 0.0004 | 0.002 | 0.034 | 0.0023 |
| WAG 1 | 4,4-DDD | 63 | 1 | 62 | 0.0214 | 0.0013 | 0.017 | 0.09 | NA |
| WAG 1 | 4,4-DDE | 63 | 1 | 62 | 0.0218 | 0.0014 | 0.017 | 0.09 | NA |
| WAG 1 | 4,4-DDT | 65 | 3 | 62 | 0.0211 | 0.0012 | 0.0076 | 0.09 | 0.0101 |
| WAG 1 | Acetone | 168 | 107 | 61 | 0.0278 | 0.0024 | 0.002 | 0.23 | 0.0293 |
| WAG 1 | Aldrin | 67 | 0 | 67 | 0.0105 | NA | 0.0083 | 0.045 | NA |
| WAG 1 | Aluminum | 136 | 135 | 1 | 12152.1588 | 558.6427 | 13.6 | 35200 | 13085.439 |
| WAG 1 | Antimony | 49 | 25 | 24 | 6.1265 | 0.3790 | 2.5 | 17.4 | 6.0617 |
| WAG 1 | Arsenic | 136 | 132 | 4 | 9.0118 | 0.5659 | 1.2 | 29.4 | 9.7694 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 1 | Barium | 136 | 135 | 1 | 107.4636 | 4.7336 | 0.45 | 410 | 115.3482 |
| WAG 1 | Benzene | 168 | 3 | 165 | 0.0076 | 0.0004 | 0.003 | 0.034 | 0.0031 |
| WAG 1 | Benzo(a)Pyrene | 123 | 58 | 65 | 0.6776 | 0.1273 | 0.039 | 12 | 0.7257 |
| WAG 1 | Beryllium | 137 | 131 | 6 | 0.9493 | 0.0369 | 0.19 | 2.6 | 1.0127 |
| WAG 1 | Bis(2-ethylhexyl)Phthalate | 123 | 85 | 38 | 0.4584 | 0.0746 | 0.022 | 8.5 | 0.4414 |
| WAG 1 | Boron | 40 | 37 | 3 | 1204.9650 | 329.8646 | 4.8 | 7000 | 1761.2341 |
| WAG 1 | Cadmium | 137 | 66 | 71 | 1.7696 | 0.1478 | 0.22 | 10.3 | 1.9618 |
| WAG 1 | Carbon tetrachloride | 168 | 2 | 166 | 0.0076 | 0.0004 | 0.005 | 0.034 | 0.0060 |
| WAG 1 | Chloroform | 168 | 44 | 124 | 0.0098 | 0.0017 | 0.001 | 0.24 | 0.0090 |
| WAG 1 | Chromium | 136 | 135 | 1 | 28.9507 | 2.4147 | 2.3 | 189 | 32.9578 |
| WAG 1 | Copper | 136 | 132 | 4 | 19.6249 | 1.5910 | 0.72 | 125 | 22.2562 |
| WAG 1 | Cyanide | 65 | 1 | 64 | 4.6813 | 0.3108 | 0.0001 | 8 | NA |
| WAG 1 | Di-n-butlyphthalate | 122 | 73 | 49 | 0.7199 | 0.0595 | 0.044 | 2.9 | 0.7003 |
| WAG 1 | Dibenzofuran | 123 | 10 | 113 | 0.5403 | 0.0512 | 0.029 | 5.5 | 0.1746 |
| WAG 1 | Dieldrin | 64 | 0 | 64 | 0.0213 | NA | 0.017 | 0.09 | NA |
| WAG 1 | Diethylphthalate | 123 | 10 | 113 | 0.5785 | 0.0578 | 0.022 | 5.5 | 0.0481 |
| WAG 1 | Endosulfan I | 67 | 0 | 67 | 0.0111 | NA | 0.0083 | 0.045 | NA |
| WAG 1 | Endosulfan II | 64 | 0 | 64 | 0.0214 | NA | 0.017 | 0.09 | NA |
| WAG 1 | Endrin | 66 | 1 | 65 | 0.0210 | 0.0012 | 0.0028 | 0.09 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 1 | Heptachlor | 67 | 1 | 66 | 0.0105 | 0.0006 | 0.0083 | 0.045 | NA |
| WAG 1 | Lead | 134 | 133 | 1 | 40.8739 | 3.3078 | 2.9 | 337 | 46.3236 |
| WAG 1 | Lindane | 67 | 0 | 67 | 0.0107 | NA | 0.0083 | 0.045 | NA |
| WAG 1 | Manganese | 136 | 135 | 1 | 841.9415 | 40.8851 | 0.45 | 2970 | 909.9661 |
| WAG 1 | Mercury | 93 | 49 | 44 | 1.3060 | 0.3266 | 0.1 | 16.4 | 1.8496 |
| WAG 1 | Methoxychlor | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | Methylene chloride | 168 | 152 | 16 | 0.0310 | 0.0035 | 0.001 | 0.36 | 0.0366 |
| WAG 1 | Molybdenum | 40 | 0 | 40 | 2.2000 | NA | 1.7 | 3.1 | NA |
| WAG 1 | Nickel | 136 | 135 | 1 | 19.2610 | 0.7882 | 3.3 | 47.7 | 20.5598 |
| WAG 1 | PCB-1016 | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | PCB-1221 | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | PCB-1232 | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | PCB-1242 | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | PCB-1248 | 67 | 0 | 67 | 0.1049 | NA | 0.083 | 0.45 | NA |
| WAG 1 | PCB-1254 | 66 | 10 | 56 | 0.3505 | 0.0922 | 0.08 | 5.8 | 0.4403 |
| WAG 1 | PCB-1260 | 67 | 10 | 57 | 0.2473 | 0.0289 | 0.088 | 1.9 | 0.2270 |
| WAG 1 | Pentachlorophenol | 123 | 5 | 118 | 2.9574 | 0.2817 | 0.053 | 26 | 0.2800 |
| WAG 1 | Selenium | 102 | 48 | 54 | 14.5650 | 1.6571 | 0.39 | 52.1 | 16.8413 |
| WAG 1 | Tetrachloroethene | 168 | 5 | 163 | 0.0076 | 0.0004 | 0.002 | 0.034 | 0.0043 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 1 | Thallium | 133 | 35 | 98 | 14.1675 | 2.1681 | 0.22 | 127 | 15.8509 |
| WAG 1 | Tin | 40 | 40 | 0 | 50.7300 | 2.0604 | 31.8 | 83.9 | 54.2015 |
| WAG 1 | Toluene | 168 | 41 | 127 | 0.0071 | 0.0004 | 0.0006 | 0.034 | 0.0035 |
| WAG 1 | Toxaphene | 67 | 0 | 67 | 0.2127 | NA | 0.17 | 0.9 | NA |
| WAG 1 | Trichloroethene | 168 | 14 | 154 | 0.0074 | 0.0005 | 0.001 | 0.034 | 0.0023 |
| WAG 1 | Uranium | 90 | 90 | 0 | 7.9570 | 3.9183 | 0.52 | 323 | 14.4699 |
| WAG 1 | Vanadium | 137 | 136 | 1 | 21.5983 | 0.7594 | 0.47 | 54.5 | 22.8507 |
| WAG 1 | Vinyl chloride | 168 | 2 | 166 | 0.0155 | 0.0009 | 0.01 | 0.068 | 0.0120 |
| WAG 1 | Zinc | 136 | 135 | 1 | 91.9930 | 8.2040 | 0.45 | 514 | 105.6279 |
| WAG 1 | Alpha-BHC | 67 | 1 | 66 | 0.0118 | 0.0013 | 0.0083 | 0.084 | NA |
| WAG 1 | Alpha-chlordane | 67 | 1 | 66 | 0.1049 | 0.0060 | 0.083 | 0.45 | NA |
| WAG 1 | Beta-BHC | 66 | 0 | 66 | 0.0105 | NA | 0.0083 | 0.045 | NA |
| WAG 1 | Delta-BHC | 67 | 0 | 67 | 0.0105 | NA | 0.0083 | 0.045 | NA |
| WAG 1 | Gamma-chlordane | 67 | 1 | 66 | 0.1043 | 0.0060 | 0.055 | 0.45 | NA |
| WAG 6 | 1,1,1-trichlorethane | 37 | 0 | 37 | 0.0065 | NA | 0.006 | 0.008 | NA |
| WAG 6 | 1,1-Dichlorethene | 37 | 0 | 37 | 0.0065 | NA | 0.006 | 0.008 | NA |
| WAG 6 | 1,2-Dichlorethane | 37 | 0 | 37 | 0.0065 | NA | 0.006 | 0.008 | NA |
| WAG 6 | 1,2-Dichlorethene | 37 | 1 | 36 | 0.0068 | 0.0002 | 0.006 | 0.015 | NA |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 6 | 1,4-Dioxane | 4 | 2 | 2 | 6.6750 | 0.3198 | 6.2 | 7.6 | 7.5588 |
| WAG 6 | 4,4-DDD | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | 4,4-DDE | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | 4,4-DDT | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | Acetone | 37 | 23 | 14 | 0.0139 | 0.0010 | 0.006 | 0.044 | 0.0147 |
| WAG 6 | Aldrin | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Aluminum | 32 | 32 | 0 | 15837.8125 | 813.9395 | 7380 | 24600 | 17217.862 |
| WAG 6 | Arsenic | 32 | 27 | 5 | 1.7666 | 0.1659 | 0.37 | 4.2 | 2.0874 |
| WAG 6 | Barium | 32 | 32 | 0 | 132.8125 | 6.2860 | 70.6 | 228 | 143.4706 |
| WAG 6 | Benzene | 37 | 0 | 37 | 0.0065 | NA | 0.006 | 0.008 | NA |
| WAG 6 | Benzo(a)pyrene | 32 | 0 | 32 | 0.4425 | NA | 0.37 | 0.52 | NA |
| WAG 6 | Beryllium | 32 | 32 | 0 | 1.3834 | 0.0605 | 0.97 | 2.4 | 1.4859 |
| WAG 6 | Bis(2-ethylhexyl)phthalate | 32 | 27 | 5 | 0.3983 | 0.0530 | 0.066 | 1.7 | 0.4624 |
| WAG 6 | Cadmium | 32 | 28 | 4 | 2.5013 | 0.1860 | 0.58 | 4 | 2.8456 |
| WAG 6 | Carbon tetrachloride | 37 | 0 | 37 | 0.0065 | NA | 0.006 | 0.008 | NA |
| WAG 6 | Chloroform | 37 | 21 | 16 | 0.0114 | 0.0017 | 0.002 | 0.064 | 0.0128 |
| WAG 6 | Chromium | 32 | 32 | 0 | 24.6031 | 1.0401 | 13.1 | 34.8 | 26.3667 |
| WAG 6 | Copper | 32 | 32 | 0 | 16.5219 | 0.9470 | 7.1 | 27.5 | 18.1276 |
| WAG 6 | Cyanide | 32 | 1 | 31 | 23.8172 | 13.0661 | 0.01 | 250 | NA |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 6 | Di-n-butlyphthalate | 32 | 0 | 32 | 0.4425 | NA | 0.37 | 0.52 | NA |
| WAG 6 | Dibenzofuran | 32 | 0 | 32 | 0.4425 | NA | 0.37 | 0.52 | NA |
| WAG 6 | Dieldrin | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | Diethylphthalate | 32 | 0 | 32 | 0.4425 | NA | 0.37 | 0.52 | NA |
| WAG 6 | Endosulfan I | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Endosulfan II | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | Endrin | 32 | 0 | 32 | 0.0213 | NA | 0.018 | 0.025 | NA |
| WAG 6 | Heptachlor | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Kepone | 4 | 0 | 4 | 0.0210 | NA | 0.019 | 0.023 | NA |
| WAG 6 | Lead | 31 | 30 | 1 | 15.4981 | 1.7097 | 0.54 | 46.2 | 18.4334 |
| WAG 6 | Lindane | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Manganese | 32 | 32 | 0 | 1037.6594 | 116.8054 | 54.1 | 3530 | 1235.7050 |
| WAG 6 | Mercury | 30 | 4 | 26 | 0.1007 | 0.0080 | 0 | 0.14 | 0.0374 |
| WAG 6 | Methoxychlor | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | Methylene chloride | 37 | 37 | 0 | 0.0283 | 0.0057 | 0.006 | 0.2 | 0.0378 |
| WAG 6 | Nickel | 32 | 32 | 0 | 38.2844 | 1.9707 | 18.7 | 59.7 | 41.6257 |
| WAG 6 | PCB-1016 | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | PCB-1221 | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | PCB-1232 | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |

Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 6 | PCB-1242 | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | PCB-1248 | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | PCB-1254 | 32 | 0 | 32 | 0.2125 | NA | 0.18 | 0.25 | NA |
| WAG 6 | PCB-1260 | 32 | 0 | 32 | 0.2125 | NA | 0.18 | 0.25 | NA |
| WAG 6 | Pentachloronitrobenzene | 4 | 0 | 4 | 0.8725 | NA | 0.82 | 1 | NA |
| WAG 6 | Pentachlorophenol | 32 | 0 | 32 | 2.1438 | NA | 1.8 | 2.5 | NA |
| WAG 6 | Selenium | 14 | 0 | 14 | 0.4479 | NA | 0.28 | 0.55 | NA |
| WAG 6 | Tetrachlorodibenzofuran | 3 | 0 | 3 | 0.0001 | NA | 0 | 1e-04 | NA |
| WAG 6 | Tetrachloroethene | 37 | 2 | 35 | 0.0063 | 0.0002 | 0.002 | 0.008 | 0.0033 |
| WAG 6 | Thallium | 32 | 0 | 32 | 0.4422 | NA | 0.23 | 0.57 | NA |
| WAG 6 | Tin | 4 | 4 | 0 | 55.0250 | 14.5400 | 25.7 | 87.1 | 89.2430 |
| WAG 6 | Toluene | 37 | 17 | 20 | 0.0044 | 0.0004 | 0.001 | 0.008 | 0.0025 |
| WAG 6 | Toxaphene | 32 | 0 | 32 | 0.2125 | NA | 0.18 | 0.25 | NA |
| WAG 6 | Trichloroethene | 37 | 13 | 24 | 0.0055 | 0.0005 | 0.001 | 0.017 | 0.0036 |
| WAG 6 | Uranium | 4 | 4 | 0 | 0.8183 | 0.0800 | 0.687 | 1.05 | 1.0065 |
| WAG 6 | Vanadium | 32 | 32 | 0 | 17.1344 | 0.8968 | 5.7 | 32.5 | 18.6549 |
| WAG 6 | Vinyl chloride | 37 | 0 | 37 | 0.0129 | NA | 0.011 | 0.015 | NA |
| WAG 6 | Zinc | 32 | 32 | 0 | 57.4594 | 3.0367 | 23.5 | 103 | 62.6082 |
| WAG 6 | Alpha-BHC | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| WAG 6 | Alpha-chlordane | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| WAG 6 | Beta-BHC | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Delta-BHC | 32 | 0 | 32 | 0.0106 | NA | 0.009 | 0.013 | NA |
| WAG 6 | Gamma-chlordane | 32 | 0 | 32 | 0.1060 | NA | 0.09 | 0.13 | NA |
| UEFPC OU 2 | Aluminum | 2 | 2 | 0 | 29900.0000 | 5600.0000 | 24300 | 35500 | 65257.009 |
| UEFPC OU 2 | Antimony | 2 | 0 | 2 | 2.6500 | NA | 2.6 | 2.7 | NA |
| UEFPC OU 2 | Arsenic | 2 | 2 | 0 | 1.4600 | 1.1400 | 0.32 | 2.6 | 8.6577 |
| UEFPC OU 2 | Barium | 2 | 2 | 0 | 149.8500 | 66.1500 | 83.7 | 216 | 567.5047 |
| UEFPC OU 2 | Beryllium | 2 | 2 | 0 | 1.2500 | 0.1500 | 1.1 | 1.4 | 2.1971 |
| UEFPC OU 2 | Cadmium | 2 | 0 | 2 | 0.6200 | NA | 0.61 | 0.63 | NA |
| UEFPC OU 2 | Chromium | 2 | 2 | 0 | 39.7000 | 5.9000 | 33.8 | 45.6 | 76.9511 |
| UEFPC OU 2 | Copper | 2 | 2 | 0 | 22.1000 | 5.2000 | 16.9 | 27.3 | 54.9315 |
| UEFPC OU 2 | Lead | 2 | 2 | 0 | 36.6000 | 33.8000 | 2.8 | 70.4 | 250.0048 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| UEFPC OU 2 | Lithium | 2 | 2 | 0 | 22.7000 | 1.4000 | 21.3 | 24.1 | 31.5393 |
| UEFPC OU 2 | Manganese | 2 | 2 | 0 | 484.0000 | 334.0000 | 150 | 818 | 2592.7930 |
| UEFPC OU 2 | Molybdenum | 2 | 0 | 2 | 1.4000 | NA | 1.4 | 1.4 | NA |
| UEFPC OU 2 | Nickel | 2 | 2 | 0 | 36.2000 | 3.3000 | 32.9 | 39.5 | 57.0354 |
| UEFPC OU 2 | Nitrate | 2 | 2 | 0 | 0.5850 | 0.0850 | 0.5 | 0.67 | 1.1217 |
| UEFPC OU 2 | Selenium | 2 | 0 | 2 | 19.5500 | NA | 19.2 | 19.9 | NA |
| UEFPC OU 2 | Strontium | 2 | 2 | 0 | 21.1000 | 15.3000 | 5.8 | 36.4 | 117.7004 |
| UEFPC OU 2 | Thallium | 2 | 0 | 2 | 4.1500 | NA | 4.1 | 4.2 | NA |
| UEFPC OU 2 | Uranium | 2 | 2 | 0 | 1.5650 | 0.7350 | 0.83 | 2.3 | 6.2056 |
| UEFPC OU 2 | Vanadium | 2 | 2 | 0 | 26.0000 | 1.4000 | 24.6 | 27.4 | 34.8393 |
| UEFPC OU 2 | Zinc | 2 | 2 | 0 | 86.2000 | 31.8000 | 54.4 | 118 | 286.9773 |
| BC OU 2 | 1,1,1-trichlorethane | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BC OU 2 | 1,1-Dichlorethene | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | 1,2-Dichlorethane | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | 1,2-Dichlorethene | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | 4,4-DDD | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | 4,4-DDE | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | 4,4-DDT | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | Acetone | 9 | 9 | 0 | 0.0514 | 0.0288 | 0.013 | 0.28 | 0.1051 |
| BC OU 2 | Aldrin | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Aluminum | 13 | 13 | 0 | 26143.8462 | 5485.3630 | 6840 | 63900 | 35920.340 |
| BC OU 2 | Antimony | 9 | 9 | 0 | 0.3089 | 0.0259 | 0.23 | 0.49 | 0.3570 |
| BC OU 2 | Arsenic | 13 | 9 | 4 | 33.3692 | 2.6757 | 15.6 | 50.3 | 35.0930 |
| BC OU 2 | Barium | 13 | 13 | 0 | 101.4000 | 29.5003 | 17.9 | 340 | 153.9779 |
| BC OU 2 | Benzene | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | Benzo(a)pyrene | 9 | 9 | 0 | 0.4989 | 0.0162 | 0.43 | 0.6 | 0.5290 |
| BC OU 2 | Beryllium | 13 | 13 | 0 | 1.0246 | 0.1631 | 0.29 | 2 | 1.3154 |
| BC OU 2 | Bis(2-ethylhexyl)Phthalate | 9 | 9 | 0 | 0.4989 | 0.0162 | 0.43 | 0.6 | 0.5290 |
| BC OU 2 | Boron | 4 | 4 | 0 | 65.5000 | 5.9090 | 50 | 78 | 79.4061 |
| BC OU 2 | Cadmium | 13 | 9 | 4 | 1.2469 | 0.4118 | 0.11 | 3.5 | 0.8571 |
| BC OU 2 | Carbon tetrachloride | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BC OU 2 | Chloroform | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | Chromium | 13 | 13 | 0 | 37.3308 | 3.8723 | 16.5 | 60 | 44.2323 |
| BC OU 2 | Copper | 13 | 13 | 0 | 39.2231 | 10.1792 | 10.3 | 131 | 57.3653 |
| BC OU 2 | Di-n-butlyphthalate | 9 | 9 | 0 | 0.4989 | 0.0162 | 0.43 | 0.6 | 0.5290 |
| BC OU 2 | Dibenzofuran | 9 | 9 | 0 | 0.4989 | 0.0162 | 0.43 | 0.6 | 0.5290 |
| BC OU 2 | Dieldrin | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | Diethylphthalate | 9 | 9 | 0 | 0.4989 | 0.0162 | 0.43 | 0.6 | 0.5290 |
| BC OU 2 | Endosulfan I | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Endosulfan II | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | Endrin | 9 | 9 | 0 | 0.0052 | 0.0002 | 0.0044 | 0.007 | 0.0056 |
| BC OU 2 | Heptachlor | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Lead | 13 | 12 | 1 | 81.0154 | 25.6587 | 18.3 | 370 | 126.8223 |
| BC OU 2 | Lindane | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Lithium | 4 | 4 | 0 | 39.2500 | 3.3758 | 33 | 48 | 47.1944 |
| BC OU 2 | Manganese | 13 | 13 | 0 | 1021.5231 | 425.208 | 55.8 | 6060 | 1779.3673 |
| BC OU 2 | Mercury | 24 | 24 | 0 | 49.0188 | 15.775 | 0.1 | 300 | 76.0554 |
| BC OU 2 | Methoxychlor | 9 | 9 | 0 | 0.0261 | 0.0012 | 0.022 | 0.033 | 0.0284 |
| BC OU 2 | Methylene chloride | 9 | 9 | 0 | 0.0161 | 0.0010 | 0.013 | 0.023 | 0.0179 |
| BC OU 2 | Molybdenum | 4 | 0 | 4 | 5.8000 | NA | 5.3 | 6 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BC OU 2 | Nickel | 13 | 13 | 0 | 32.6000 | 9.9436 | 5.8 | 147 | 50.3224 |
| BC OU 2 | Niobium | 4 | 1 | 3 | 9.8500 | 0.4699 | 8.7 | 11 | NA |
| BC OU 2 | PCB-1016 | 9 | 9 | 0 | 0.0521 | 0.0023 | 0.044 | 0.065 | 0.0565 |
| BC OU 2 | PCB-1221 | 9 | 9 | 0 | 0.1040 | 0.0045 | 0.088 | 0.13 | 0.1124 |
| BC OU 2 | PCB-1232 | 9 | 9 | 0 | 0.0521 | 0.0023 | 0.044 | 0.065 | 0.0565 |
| BC OU 2 | PCB-1242 | 9 | 9 | 0 | 0.0521 | 0.0023 | 0.044 | 0.065 | 0.0565 |
| BC OU 2 | PCB-1248 | 9 | 9 | 0 | 0.0521 | 0.0023 | 0.044 | 0.065 | 0.0565 |
| BC OU 2 | PCB-1254 | 9 | 9 | 0 | 0.0521 | 0.0023 | 0.044 | 0.065 | 0.0565 |
| BC OU 2 | PCB-1260 | 9 | 9 | 0 | 0.0416 | 0.0032 | 0.021 | 0.05 | 0.0475 |
| BC OU 2 | Pentachlorophenol | 9 | 9 | 0 | 1.2111 | 0.0455 | 1 | 1.5 | 1.2957 |
| BC OU 2 | Selenium | 9 | 9 | 0 | 1.0944 | 0.3730 | 0.24 | 3.3 | 1.7881 |
| BC OU 2 | Strontium | 4 | 4 | 0 | 109.9250 | 10.1746 | 82.7 | 126 | 133.8695 |
| BC OU 2 | Tetrachloroethene | 9 | 9 | 0 | 0.0074 | 0.0002 | 0.007 | 0.008 | 0.0078 |
| BC OU 2 | Thallium | 9 | 9 | 0 | 0.3144 | 0.0269 | 0.21 | 0.44 | 0.3644 |
| BC OU 2 | Toluene | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | Toxaphene | 9 | 9 | 0 | 0.2611 | 0.0122 | 0.22 | 0.33 | 0.2838 |
| BC OU 2 | Trichloroethene | 9 | 9 | 0 | 0.0077 | 0.0002 | 0.007 | 0.009 | 0.0081 |
| BC OU 2 | Uranium | 20 | 20 | 0 | 2.0408 | 0.2752 | 0.52 | 5.29 | 2.5166 |
| BC OU 2 | Vanadium | 13 | 13 | 0 | 54.8385 | 4.3422 | 33 | 82.5 | 62.5775 |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| BC OU 2 | Vinyl chloride | 9 | 9 | 0 | 0.0153 | 0.0005 | 0.013 | 0.018 | 0.0162 |
| BC OU 2 | Zinc | 13 | 13 | 0 | 113.2077 | 20.3168 | 41 | 302 | 149.4180 |
| BC OU 2 | Zirconium | 4 | 4 | 0 | 59.2500 | 6.4727 | 46 | 77 | 74.4826 |
| BC OU 2 | Alpha-BHC | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Alpha-chlordane | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Beta-BHC | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Delta-BHC | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| BC OU 2 | Gamma-chlordane | 9 | 9 | 0 | 0.0026 | 0.0001 | 0.0022 | 0.003 | 0.0028 |
| SCF | 1,1,1-trichlorethane | 84 | 13 | 71 | 0.4363 | 0.3034 | 4e-05 | 19.21 | 0.9550 |
| SCF | 1,1-Dichlorethene | 154 | 9 | 145 | 10.4636 | 5.2994 | 0.002 | 518.1 | 19.6786 |
| SCF | 1,2-Dichlorethane | 84 | 4 | 80 | 60.8926 | 42.2368 | 0.01 | 2591 | 157.2160 |
| SCF | 1,2-Dichlorethene | 14 | 0 | 14 | 0.0186 | NA | 0.01 | 0.042 | NA |
| SCF | 4,4-DDD | 23 | 5 | 18 | 0.0045 | 0.0006 | 9e-05 | 0.011 | 0.0015 |
| SCF | 4,4-DDE | 23 | 13 | 10 | 0.0030 | 0.0006 | 0.0002 | 0.014 | 0.0018 |
| SCF | 4,4-DDT | 23 | 9 | 14 | 0.0058 | 0.0015 | 0.0002 | 0.03 | 0.0065 |
| SCF | Acetone | 84 | 16 | 68 | 97.9546 | 67.5711 | 0.011 | 4145 | 212.9860 |
| SCF | Aldrin | 23 | 3 | 20 | 0.0026 | 0.0004 | 0.0001 | 0.007 | 0.0004 |
| SCF | Aluminum | 22 | 22 | 0 | 16294.0455 | 2471.5459 | 149 | 47000 | 20546.941 |

Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| SCF | Antimony | 103 | 91 | 12 | 3.1252 | 0.7214 | 0.094 | 38 | 1.2148 |
| SCF | Arsenic | 113 | 111 | 2 | 12.7714 | 1.0468 | 0.8 | 103.7 | 14.5344 |
| SCF | Barium | 22 | 20 | 2 | 111.6045 | 15.9635 | 0.4 | 322 | 139.7386 |
| SCF | Benzene | 84 | 7 | 77 | 0.9165 | 0.6335 | 0.0003 | 38.86 | 2.0400 |
| SCF | Benzo(a)pyrene | 22 | 7 | 15 | 0.4829 | 0.0640 | 0.058 | 1.1 | 0.3224 |
| SCF | Beryllium | 22 | 12 | 10 | 1.4800 | 0.1716 | 0.25 | 3.9 | 1.6114 |
| SCF | Bis(2-ethylhexyl)phthalate | 22 | 7 | 15 | 0.4390 | 0.0690 | 0.05 | 1.1 | 0.1756 |
| SCF | Cadmium | 113 | 91 | 22 | 6.1319 | 0.9122 | 0 | 85.99 | 7.4130 |
| SCF | Carbon tetrachloride | 84 | 6 | 78 | 0.0031 | 0.0009 | 0 | 0.042 | 0.0001 |
| SCF | Chloroform | 84 | 6 | 78 | 0.8859 | 0.6124 | 0.0003 | 37.56 | 1.9872 |
| SCF | Chromium | 113 | 110 | 3 | 56.8916 | 2.4701 | 2 | 204.7 | 61.1572 |
| SCF | Copper | 22 | 18 | 4 | 20.5545 | 3.9385 | 3 | 81.2 | 27.8990 |
| SCF | Di-n-butlyphthalate | 22 | 4 | 18 | 0.4705 | 0.0686 | 0.061 | 1.4 | 0.1183 |
| SCF | Dibenzofuran | 22 | 1 | 21 | 0.5218 | 0.0487 | 0.29 | 1.1 | NA |
| SCF | Dieldrin | 23 | 7 | 16 | 0.0041 | 0.0007 | 0.0002 | 0.011 | 0.0013 |
| SCF | Diethylphthalate | 22 | 0 | 22 | 0.5723 | NA | 0.33 | 1.4 | NA |
| SCF | Endosulfan I | 23 | 1 | 22 | 0.0028 | 0.0003 | 0.0009 | 0.007 | NA |
| SCF | Endosulfan II | 23 | 0 | 23 | 0.0056 | NA | 0.0033 | 0.014 | NA |
| SCF | Endrin | 23 | 4 | 19 | 0.0046 | 0.0006 | 7e-05 | 0.011 | 0.0011 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| SCF | Heptachlor | 23 | 1 | 22 | 0.0028 | 0.0003 | 0.0005 | 0.007 | NA |
| SCF | Lead | 22 | 22 | 0 | 41.5059 | 6.2219 | 0.43 | 135 | 52.2122 |
| SCF | Lindane | 23 | 0 | 23 | 0.0029 | NA | 0.0017 | 0.007 | NA |
| SCF | Manganese | 22 | 21 | 1 | 1392.0923 | 265.3807 | 0.8 | 4080 | 1849.2636 |
| SCF | Mercury | 113 | 102 | 11 | 0.6817 | 0.1102 | 0 | 6.6 | 0.8542 |
| SCF | Methoxychlor | 23 | 3 | 20 | 0.0266 | 0.0030 | 0.0024 | 0.071 | 0.0142 |
| SCF | Methylene chloride | 154 | 8 | 146 | 136.1755 | 68.9493 | 0.011 | 6736 | 281.1491 |
| SCF | Nickel | 22 | 15 | 7 | 18.4182 | 1.8591 | 5.6 | 37.2 | 20.3718 |
| SCF | PCB-1016 | 23 | 0 | 23 | 0.0564 | NA | 0.033 | 0.14 | NA |
| SCF | PCB-1221 | 23 | 0 | 23 | 0.1152 | NA | 0.066 | 0.28 | NA |
| SCF | PCB-1232 | 23 | 0 | 23 | 0.0564 | NA | 0.033 | 0.14 | NA |
| SCF | PCB-1242 | 23 | 0 | 23 | 0.0564 | NA | 0.033 | 0.14 | NA |
| SCF | PCB-1248 | 23 | 0 | 23 | 0.0564 | NA | 0.033 | 0.14 | NA |
| SCF | PCB-1254 | 23 | 3 | 20 | 0.0567 | 0.0064 | 0.02 | 0.14 | 0.0375 |
| SCF | PCB-1260 | 23 | 4 | 19 | 0.0665 | 0.0126 | 0.033 | 0.31 | 0.0694 |
| SCF | Pentachlorophenol | 103 | 82 | 21 | 0.2657 | 0.0571 | 0 | 2.7 | 0.0052 |
| SCF | Selenium | 110 | 91 | 19 | 2.7963 | 0.1575 | 0.0387 | 7.903 | 2.9646 |
| SCF | Tetrachloroethene | 155 | 10 | 145 | 0.5462 | 0.3456 | 3e-05 | 38.86 | 1.1422 |
| SCF | Thallium | 22 | 0 | 22 | 1.3600 | NA | 0.6 | 3.3 | NA |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| SCF | Toluene | 84 | 7 | 77 | 0.9167 | 0.6335 | 0.0003 | 38.86 | 2.0452 |
| SCF | Toxaphene | 23 | 0 | 23 | 0.2917 | NA | 0.17 | 0.71 | NA |
| SCF | Trichloroethene | 154 | 14 | 140 | 0.7824 | 0.4186 | 0.0001 | 44.04 | 1.4930 |
| SCF | Uranium | 91 | 91 | 0 | 3.1277 | 0.1117 | 1.1902 | 6.008 | 3.3133 |
| SCF | Vanadium | 20 | 18 | 2 | 31.4000 | 4.3587 | 2 | 67.3 | 38.9609 |
| SCF | Vinyl chloride | 14 | 0 | 14 | 0.0186 | NA | 0.01 | 0.042 | NA |
| SCF | Zinc | 113 | 111 | 2 | 114.1718 | 19.2046 | 1.9 | 1524 | 146.0309 |
| SCF | AlPha-BHC | 23 | 0 | 23 | 0.0029 | NA | 0.0017 | 0.007 | NA |
| SCF | Alpha-chlordane | 23 | 5 | 18 | 0.0026 | 0.0004 | 0.0001 | 0.007 | 0.0013 |
| SCF | Beta-BHC | 23 | 0 | 23 | 0.0029 | NA | 0.0017 | 0.007 | NA |
| SCF | Delta-BHC | 23 | 4 | 19 | 0.0026 | 0.0004 | 8e-05 | 0.007 | 0.0004 |
| SCF | Gamma-chlordane | 23 | 3 | 20 | 0.0027 | 0.0003 | 0.0005 | 0.007 | 0.0010 |
| K-1420 OU | 1,1,1-trichlorethane | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | 1,1-Dichlorethene | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | 1,2-Dichlorethane | 5 | 3 | 2 | 0.0054 | 0.0012 | 0.002 | 0.009 | 0.0074 |
| K-1420 OU | 1,2-Dichlorethene | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | 4,4-DDD | 4 | 0 | 4 | 0.0203 | NA | 0.019 | 0.022 | NA |
| K-1420 OU | 4,4-DDE | 4 | 0 | 4 | 0.0203 | NA | 0.019 | 0.022 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1420 OU | 4,4-DDT | 4 | 0 | 4 | 0.0630 | NA | 0.019 | 0.19 | NA |
| K-1420 OU | Acetone | 5 | 3 | 2 | 0.0190 | 0.0028 | 0.012 | 0.025 | 0.0249 |
| K-1420 OU | Aldrin | 4 | 1 | 3 | 0.0114 | 0.0012 | 0.0096 | 0.015 | NA |
| K-1420 OU | Aluminum | 2 | 2 | 0 | 19950.0000 | 4650.0000 | 15300 | 24600 | 49308.945 |
| K-1420 OU | Antimony | 2 | 0 | 2 | 3.9500 | NA | 3.9 | 4 | NA |
| K-1420 OU | Arsenic | 4 | 4 | 0 | 18.4700 | 3.6054 | 8.38 | 25.5 | 26.9549 |
| K-1420 OU | Barium | 2 | 2 | 0 | 31.8500 | 8.2500 | 23.6 | 40.1 | 83.9384 |
| K-1420 OU | Benzene | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | Benzo(a)pyrene | 5 | 2 | 3 | 0.3780 | 0.0659 | 0.12 | 0.48 | 0.3862 |
| K-1420 OU | Beryllium | 2 | 2 | 0 | 0.3750 | 0.1450 | 0.23 | 0.52 | 1.2905 |
| K-1420 OU | Bis(2-ethylhexyl)phthalate | 5 | 4 | 1 | 0.2150 | 0.0637 | 0.075 | 0.4 | 0.2892 |
| K-1420 OU | Boron | 2 | 1 | 1 | 2.7000 | 1.4000 | 1.3 | 4.1 | NA |
| K-1420 OU | Cadmium | 2 | 0 | 2 | 0.6600 | NA | 0.66 | 0.66 | NA |
| K-1420 OU | Carbon tetrachloride | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | Chloroform | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | Chromium | 3 | 2 | 1 | 15.2000 | 7.4505 | 0.4 | 24.1 | 25.4717 |
| K-1420 OU | Chromium(+6) | 1 | 0 | 1 | 0.4000 | NA | 0.4 | 0.4 | NA |
| K-1420 OU | Copper | 2 | 2 | 0 | 26.2000 | 3.3000 | 22.9 | 29.5 | 47.0354 |
| K-1420 OU | Di-n-butlyphthalate | 5 | 0 | 5 | 0.5080 | NA | 0.39 | 0.86 | NA |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1420 OU | Dibenzofuran | 5 | 0 | 5 | 0.5080 | NA | 0.39 | 0.86 | NA |
| K-1420 OU | Dieldrin | 4 | 0 | 4 | 0.0203 | NA | 0.019 | 0.022 | NA |
| K-1420 OU | Diethylphthalate | 5 | 0 | 5 | 0.5080 | NA | 0.39 | 0.86 | NA |
| K-1420 OU | Endosulfan I | 4 | 0 | 4 | 0.0100 | NA | 0.0095 | 0.011 | NA |
| K-1420 OU | Endosulfan II | 4 | 0 | 4 | 0.0203 | NA | 0.019 | 0.022 | NA |
| K-1420 OU | Endrin | 4 | 0 | 4 | 0.0203 | NA | 0.019 | 0.022 | NA |
| K-1420 OU | Fluoride | 4 | 2 | 2 | 40.0150 | 23.0854 | 0.03 | 80 | 0.0300 |
| K-1420 OU | Heptachlor | 4 | 0 | 4 | 0.0100 | NA | 0.0095 | 0.011 | NA |
| K-1420 OU | Lead | 4 | 4 | 0 | 66.2500 | 10.3119 | 48.2 | 93.2 | 90.5177 |
| K-1420 OU | Lindane | 4 | 0 | 4 | 0.0100 | NA | 0.0095 | 0.011 | NA |
| K-1420 OU | Lithium | 2 | 2 | 0 | 52.2000 | 27.9000 | 24.3 | 80.1 | 228.3537 |
| K-1420 OU | Manganese | 2 | 2 | 0 | 470.0000 | 236.0000 | 234 | 706 | 1960.0454 |
| K-1420 OU | Mercury | 4 | 3 | 1 | 0.2025 | 0.0936 | 0.03 | 0.45 | 0.4301 |
| K-1420 OU | Methoxychlor | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | Methylene chloride | 5 | 4 | 1 | 0.0070 | 0.0011 | 0.004 | 0.01 | 0.0093 |
| K-1420 OU | Molybdenum | 2 | 0 | 2 | 1.3000 | NA | 1.3 | 1.3 | NA |
| K-1420 OU | Nickel | 2 | 2 | 0 | 24.0500 | 1.5500 | 22.5 | 25.6 | 33.8363 |
| K-1420 OU | 14681631 | 6 | 0 | 6 | 0.0600 | NA | 0.03 | 0.12 | NA |
| K-1420 OU | Nitrate | 4 | 2 | 2 | 20.0075 | 11.5427 | 0.01 | 40 | 0.0268 |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1420 OU | PCB-1016 | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | PCB-1221 | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | PCB-1232 | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | PCB-1242 | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | PCB-1248 | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | PCB-1254 | 4 | 3 | 1 | 0.6625 | 0.4128 | 0.22 | 1.9 | 1.6934 |
| K-1420 OU | PCB-1260 | 4 | 0 | 4 | 0.2025 | NA | 0.19 | 0.22 | NA |
| K-1420 OU | Pentachlorophenol | 5 | 1 | 4 | 2.1060 | 0.6458 | 0.13 | 4.2 | NA |
| K-1420 OU | Selenium | 1 | 0 | 1 | 0.2600 | NA | 0.26 | 0.26 | NA |
| K-1420 OU | Strontium | 2 | 2 | 0 | 38.2500 | 34.4500 | 3.8 | 72.7 | 255.7587 |
| K-1420 OU | Tetrachloroethene | 5 | 1 | 4 | 0.0060 | 0.0003 | 0.005 | 0.007 | NA |
| K-1420 OU | Thallium | 2 | 1 | 1 | 0.7200 | 0.2800 | 0.44 | 1 | NA |
| K-1420 OU | Toluene | 5 | 0 | 5 | 0.0062 | NA | 0.006 | 0.007 | NA |
| K-1420 OU | Toxaphene | 4 | 0 | 4 | 0.2025 | NA | 0.19 | 0.22 | NA |
| K-1420 OU | Trichloroethene | 5 | 1 | 4 | 0.0410 | 0.0348 | 0.006 | 0.18 | NA |
| K-1420 OU | Uranium | 12 | 12 | 0 | 139.1092 | 79.8794 | 1.98 | 929 | 282.5634 |
| K-1420 OU | Vanadium | 2 | 2 | 0 | 48.9000 | 14.6000 | 34.3 | 63.5 | 141.0808 |
| K-1420 OU | Vinyl chloride | 5 | 0 | 5 | 0.0128 | NA | 0.012 | 0.014 | NA |
| K-1420 OU | Zinc | 2 | 2 | 0 | 84.3500 | 11.0500 | 73.3 | 95.4 | 154.1170 |

## Table G.5 (continued)

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1420 OU | Alpha-BHC | 4 | 0 | 4 | 0.0100 | NA | 0.0095 | 0.011 | NA |
| K-1420 OU | Alpha-chlordane | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| K-1420 OU | Beta-BHC | 4 | 1 | 3 | 0.0137 | 0.0035 | 0.0096 | 0.024 | NA |
| K-1420 OU | Delta-BHC | 4 | 0 | 4 | 0.0100 | NA | 0.0095 | 0.011 | NA |
| K-1420 OU | Gamma-chlordane | 4 | 0 | 4 | 0.1003 | NA | 0.095 | 0.11 | NA |
| | | | | | | | | | |
| K-1414 | 1,1,1-trichlorethane | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | 1,1-Dichlorethene | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | 1,2-Dichlorethane | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | 1,2-Dichlorethene | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Acetone | 2 | 1 | 1 | 0.0310 | 0.0190 | 0.012 | 0.05 | NA |
| K-1414 | Benzene | 4 | 0 | 4 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Benzo(a)pyrene | 2 | 1 | 1 | 0.2870 | 0.1930 | 0.094 | 0.48 | NA |
| K-1414 | Bis(2-ethylhexyl)phthalate | 2 | 1 | 1 | 0.2235 | 0.1665 | 0.057 | 0.39 | NA |
| K-1414 | Carbon tetrachloride | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Chloroform | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Di-n-butlyphthalate | 2 | 2 | 0 | 0.7400 | 0.2600 | 0.48 | 1 | 2.3816 |
| K-1414 | Dibenzofuran | 2 | 0 | 2 | 0.4350 | NA | 0.39 | 0.48 | NA |
| K-1414 | Diethylphthalate | 2 | 0 | 2 | 0.4350 | NA | 0.39 | 0.48 | NA |

**Table G.5 (continued)**

| LOCATION | ANALYTE | OBS | # DET | # NONDET | MEAN[a] | SEM | MIN | MAX | PLE 95% UCB |
|---|---|---|---|---|---|---|---|---|---|
| K-1414 | Methylene chloride | 2 | 2 | 0 | 0.0380 | 0.0190 | 0.019 | 0.057 | 0.1580 |
| K-1414 | Pentachlorophenol | 2 | 0 | 2 | 1.0700 | NA | 0.94 | 1.2 | NA |
| K-1414 | Tetrachloroethene | 2 | 1 | 1 | 0.0040 | 0.0020 | 0.002 | 0.006 | NA |
| K-1414 | Toluene | 4 | 0 | 4 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Trichloroethene | 2 | 0 | 2 | 0.0065 | NA | 0.006 | 0.007 | NA |
| K-1414 | Vinyl chloride | 2 | 0 | 2 | 0.0130 | NA | 0.012 | 0.014 | NA |

[a] Mean: In cases where only a single detected value was observed at that location, the single detected concentration is presented. The PLE 95% UCB is designated with NA.

[b] NA= Not Available.

**Table G.6. Contaminant concentrations in soil (mg/kg) on the ORR compared with background soil levels (ESD 1993)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]- Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| BCVOU1 | DG, NL | Aluminum | 25000 | 23200 | 12636.1538 | 14834.7039 | NO |
| BCVOU1 | NL | Antimony | 0.485 | NA | 1.0308 | 1.7371 | YES |
| BCVOU1 | DG, NL | Arsenic | 8.18 | 7.97 | 9.2692 | 13.3522 | YES |
| BCVOU1 | DG, NL | Barium | 129 | 97.8 | 264.3154 | 403.0086 | YES |
| BCVOU1 | DG, NL | Beryllium | 0.964 | 0.957 | 1.0508 | 1.4283 | YES |
| BCVOU1 | | Cadmium | NA | NA | 5.3800 | 10.7364 | YES |
| BCVOU1 | DG, NL | Chromium | 34.0 | 29.2 | 48.9769 | 68.3643 | YES |
| BCVOU1 | DG, NL | Copper | 20.50 | 14.90 | 972.0615 | 1779.9973 | YES |
| BCVOU1 | DG, NL | Lead | 27.7 | 25.1 | 287.4615 | 543.2465 | YES |
| BCVOU1 | DG, NL | Manganese | 1370 | 895 | 910.1000 | 1162.3027 | NO |
| BCVOU1 | DG, NL | Mercury | 0.3700 | 0.2170 | 18.9815 | 31.8423 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| BCVOU1 | | Molybdenum | NA | NA | 8.8554 | 18.2024 | YES |
| BCVOU1 | DG, NL | Nickel | 36.10 | 26.60 | 85.1077 | 137.5290 | YES |
| BCVOU1 | DG, NL | Vanadium | 39.1 | 37.1 | 26.9462 | 31.7758 | NO |
| BCVOU1 | DG, NL | Zinc | 62.6 | 46.8 | 668.9077 | 1133.3062 | YES |
| LEFPC | CHI | Aluminum | 18600 | NA | 12605.6667 | 13229.7316 | NO |
| LEFPC | | Antimony | NA | NA | 1.2837 | 0.7872 | YES |
| LEFPC | CHI | Arsenic | 9.73 | NA | 7.7788 | 7.9621 | NO |
| LEFPC | CHI | Barium | 99.6 | NA | 121.3567 | 130.0473 | YES |
| LEFPC | CHI | Beryllium | 1.120 | NA | 0.9165 | 0.9781 | NO |
| LEFPC | | Cadmium | NA | NA | 4.0894 | 4.6446 | YES |
| LEFPC | CHI | Chromium | 38.5 | NA | 64.6076 | 65.5307 | YES |
| LEFPC | CHI | Copper | 14.50 | NA | 78.0333 | 89.6714 | YES |
| LEFPC | CHI (DG[c]) | Cyanide | .583 | NA | 3.0242 | 5.8240 | YES |
| LEFPC | CHI | Lead | 43.2 | NA | 53.7993 | 61.4855 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| LEFPC | CHI | Manganese | 2290 | NA | 1110.0367 | 1194.6395 | NO |
| LEFPC | CHI | Mercury | 0.5790 | NA | 38.4880 | 41.6088 | YES |
| LEFPC | CHI | Nickel | 21.30 | NA | 34.3673 | 37.9061 | YES |
| LEFPC | CHI | Selenium | 0.962 | NA | 13.5663 | 8.7045 | YES |
| LEFPC | | Thallium | NA | NA | 0.8092 | NA | YES |
| LEFPC | CHI | Vanadium | 42.0 | NA | 26.8927 | 28.3057 | NO |
| LEFPC | CHI | Zinc | 56.9 | NA | 179.9126 | 166.1992 | YES |
| K-1407 OU | CHI | Aluminum | 18600 | NA | 26562.9630 | 28723.5267 | YES |
| K-1407 OU | CHI | Antimony | NA | NA | 7.1506 | NA | YES |
| K-1407 OU | CHI | Arsenic | 9.73 | NA | 12.4333 | 13.0681 | YES |
| K-1407 OU | CHI | Barium | 99.6 | NA | 110.4938 | 125.2752 | YES |
| K-1407 OU | CHI | Beryllium | 1.120 | NA | 1.0159 | 1.1269 | YES |
| K-1407 OU | CHI | Boron | NA | NA | 6.4191 | 8.3996 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]- Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| K-1407 OU | CHI | Cadmium | NA | NA | 1.8799 | 2.1492 | YES |
| K-1407 OU | CHI | Chromium | 38.5 | NA | 61.0370 | 69.8642 | YES |
| K-1407 OU | CHI | Copper | 14.50 | NA | 40.8537 | 48.6398 | YES |
| K-1407 OU | CHI | Lead | 43.2 | NA | 30.6753 | 32.9964 | NO |
| K-1407 OU | CHI | Manganese | 2290 | NA | 1184.7778 | 1355.2705 | NO |
| K-1407 OU | CHI | Mercury | 0.5790 | NA | 4.7250 | 6.3965 | YES |
| K-1407 OU | CHI | Molybdenum | 3.20 | NA | 1.8006 | 1.5498 | NO |
| K-1407 OU | CHI | Nickel | 21.30 | NA | 192.1790 | 251.0899 | YES |
| K-1407 OU | CHI | Selenium | 0.962 | NA | 7.1519 | NA | YES |
| K-1407 OU | CHI | Strontium | 16.000 | NA | 18.1420 | 20.6695 | YES |
| K-1407 OU | CHI | Vanadium | 42.0 | NA | 38.9753 | 41.3405 | NO |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]- Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| K-1407 OU | CHI | Zinc | 56.9 | NA | 59.7778 | 64.4711 | YES |
| WAG 1 | DG, NL | Aluminum | 25000 | 232000 | 12152.1588 | 13085.4391 | NO |
| WAG 1 | NL | Antimony | 0.485 | NA | 6.1265 | 6.0617 | YES |
| WAG 1 | DG, NL | Arsenic | 8.18 | 7.97 | 9.0118 | 9.7694 | YES |
| WAG 1 | DG, NL | Barium | 129.0 | 97.8 | 107.4636 | 115.3482 | NO |
| WAG 1 | DG, NL | Beryllium | 0.964 | 0.957 | 0.9493 | 1.0127 | YES |
| WAG 1 | DG | Boron | 22.70 | NA | 1204.9650 | 1761.2341 | YES |
| WAG 1 | | Cadmium | NA | NA | 1.7696 | 1.9618 | YES |
| WAG 1 | DG, NL | Chromium | 34.0 | 29.2 | 28.9507 | 32.9578 | YES |
| WAG 1 | DG, NL | Copper | 20.50 | 14.90 | 19.6249 | 22.2562 | YES |
| WAG 1 | DG | Cyanide | 0.398 | NA | 4.6813 | NA | YES |
| WAG 1 | DG, NL | Lead | 27.7 | 25.1 | 40.8739 | 46.3236 | YES |
| WAG 1 | DG, NL | Manganese | 1370 | 895 | 841.9415 | 909.9661 | NO |
| WAG 1 | DG, NL | Mercury | 0.3700 | 0.2170 | 1.3060 | 1.8496 | YES |
| WAG 1 | DG, NL | Nickel | 21.40 | 16.70 | 19.2610 | 20.5598 | NO |
| WAG 1 | DG, NL | Selenium | 0.931 | 0.718 | 14.5650 | 16.8413 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| WAG 1 | DG | Thallium | 0.556 | NA | 14.1675 | 15.8509 | YES |
| WAG 1 | DG, NL | Vanadium | 39.1 | 37.1 | 21.5983 | 22.8507 | NO |
| WAG 1 | DG, NL | Zinc | 62.6 | 46.8 | 91.9930 | 105.6279 | YES |
| WAG 6 | DG, NL | Aluminum | 25000 | 23200 | 15837.8125 | 17217.8622 | NO |
| WAG 6 | DG, NL | Arsenic | 8.18 | 7.97 | 1.7666 | 2.0874 | NO |
| WAG 6 | DG, NL | Barium | 129.0 | 97.8 | 132.8125 | 143.4706 | YES |
| WAG 6 | DG, NL | Beryllium | 0.964 | 0.957 | 1.3834 | 1.4859 | YES |
| WAG 6 | | Cadmium | NA | NA | 2.5013 | 2.8456 | YES |
| WAG 6 | DG, NL | Chromium | 34.0 | 29.2 | 24.6031 | 26.3667 | NO |
| WAG 6 | DG, NL | Copper | 20.50 | 14.90 | 16.5219 | 18.1276 | NO |
| WAG 6 | DG, NL | Cyanide | 0.281 | NA | 23.8172 | NA | YES |
| WAG 6 | DG, NL | Lead | 27.7 | 25.1 | 15.4981 | 18.4334 | NO |
| WAG 6 | DG, NL | Manganese | 1370 | 895 | 1037.6594 | 1235.7050 | NO |
| WAG 6 | DG, NL | Mercury | 0.3700 | 0.2170 | 0.1007 | 0.0374 | NO |
| WAG 6 | DG, NL | Nickel | 36.10 | 26.60 | 38.2844 | 41.6257 | YES |
| WAG 6 | DG, NL | Vanadium | 39.1 | 37.1 | 17.1344 | 18.6549 | NO |
| WAG 6 | DG, NL | Zinc | 62.6 | 46.8 | 57.4594 | 62.6082 | NO |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| UEFPC OU 2 | CHI | Aluminum | 18600 | NA | 29900.0000 | 65257.0085 | YES |
| UEFPC OU 2 | CHI | Arsenic | 9.73 | NA | 1.4600 | 8.6577 | NO |
| UEFPC OU 2 | CHI | Barium | 99.6 | NA | 149.8500 | 567.5047 | YES |
| UEFPC OU 2 | CHI | Beryllium | 1.120 | NA | 1.2500 | 2.1971 | YES |
| UEFPC OU 2 | CHI | Chromium | 38.5 | NA | 39.7000 | 76.9511 | YES |
| UEFPC OU 2 | CHI | Copper | 14.50 | NA | 22.1000 | 54.9315 | YES |
| UEFPC OU 2 | CHI | Lead | 43.2 | NA | 36.6000 | 250.0048 | YES |
| UEFPC OU 2 | CHI | Lithium | 17.40 | NA | 22.7000 | 31.5393 | YES |
| UEFPC OU 2 | CHI | Manganese | 2290 | NA | 484.0000 | 2592.7930 | YES |
| UEFPC OU 2 | CHI | Nickel | 21.30 | NA | 36.2000 | 57.0354 | YES |
| UEFPC OU 2 | CHI | Strontium | 16.000 | NA | 21.1000 | 117.7004 | YES |

Table G.6 (continued)

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| UEFPC OU 2 | CHI | Vanadium | 42.0 | NA | 26.0000 | 34.8393 | NO |
| UEFPC OU 2 | CHI | Zinc | 56.9 | NA | 86.2000 | 286.9773 | YES |
| BC OU 2 | CR | Aluminum | 11800 | NA | 26143.8462 | 35920.3403 | YES |
| BC OU 2 | | Antimony | NA | NA | 0.3089 | 0.3570 | YES |
| BC OU 2 | CR | Arsenic | 30.70 | NA | 33.3692 | 35.0930 | YES |
| BC OU 2 | CR | Barium | 93.2 | NA | 101.4000 | 153.9779 | YES |
| BC OU 2 | CR | Beryllium | 0.634 | NA | 1.0246 | 1.3154 | YES |
| BC OU 2 | CR | Boron | NA | NA | 65.5000 | 79.4061 | YES |
| BC OU 2 | CR | Cadmium | NA | NA | 1.2469 | 0.8571 | YES |
| BC OU 2 | CR | Chromium | 18.3 | NA | 37.3308 | 44.2323 | YES |
| BC OU 2 | CR | Copper | 8.19 | NA | 39.2231 | 57.3653 | YES |
| BC OU 2 | CR | Lead | 23.00 | NA | 81.0154 | 126.8223 | YES |
| BC OU 2 | CR | Lithium | 3.48 | NA | 39.2500 | 47.1944 | YES |
| BC OU 2 | CR | Manganese | 1460 | NA | 1021.5231 | 1779.3673 | YES |
| BC OU 2 | CR | Mercury | 0.184 | NA | 49.0188 | 76.0554 | YES |

Table G.6 (continued)

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]- Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| BC OU 2 | CR | Nickel | 9.71 | NA | 32.6000 | 50.3224 | YES |
| BC OU 2 | CR | Selenium | 0.803 | NA | 1.0944 | 1.7881 | YES |
| BC OU 2 | CR | Strontium | 4.810 | NA | 109.9250 | 133.8695 | YES |
| BC OU 2 | CR | Thallium | 1.370 | NA | 0.3144 | 0.3644 | NO |
| BC OU 2 | CR | Vanadium | 30.3 | NA | 54.8385 | 62.5775 | YES |
| BC OU 2 | CR | Zinc | 43.2 | NA | 113.2077 | 149.4180 | YES |
| SCF | CHI | Aluminum | 18600 | NA | 16294.0455 | 20546.9405 | YES |
| SCF | CHI | Antimony | NA | NA | 3.1252 | 1.2148 | YES |
| SCF | CHI | Arsenic | 7.99 | NA | 12.7714 | 14.5344 | YES |
| SCF | CHI | Barium | 103.0 | NA | 111.6045 | 139.7386 | YES |
| SCF | CHI | Beryllium | 1.250 | NA | 1.4800 | 1.6114 | YES |
| SCF | CHI | Cadmium | NA | NA | 6.1319 | 7.4130 | YES |
| SCF | CHI | Chromium | 40.2 | NA | 56.8916 | 61.1572 | YES |
| SCF | CHI | Copper | 20.60 | NA | 20.5545 | 27.8990 | YES |
| SCF | CHI | Lead | 51.1 | NA | 41.5059 | 52.2122 | YES |
| SCF | CHI | Manganese | 1440 | NA | 1392.0923 | 1849.2636 | YES |
| SCF | CHI | Mercury | 0.1880 | NA | 0.6817 | 0.8542 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]- Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| SCF | CHI | Nickel | 16.70 | NA | 18.4182 | 20.3718 | YES |
| SCF | CHI | Selenium | 0.931 | NA | 2.7963 | 2.9646 | YES |
| SCF | CHI | Vanadium | 41.9 | NA | 31.4000 | 38.9609 | NO |
| SCF | CHI | Zinc | 55.5 | NA | 114.1718 | 146.0309 | YES |
| K-1420 OU | CK[d] | Aluminum | 15300 | 9510 | 19950.0000 | 49308.9445 | YES |
| K-1420 OU | CK | Arsenic | 30.70 | 11.80 | 18.4700 | 26.9549 | NO |
| K-1420 OU | CK | Barium | 151.0 | 69.5 | 31.8500 | 83.9384 | YES |
| K-1420 OU | CK | Beryllium | 0.911 | 0.460 | 0.3750 | 1.2905 | YES |
| K-1420 OU | CK | Boron | 4.87 | NA | 2.7000 | NA | NO |
| K-1420 OU | CK | Chromium | 23.9 | 15.0 | 15.2000 | 25.4717 | YES |
| K-1420 OU | CK | Copper | 11.6 | 5.26 | 26.2000 | 47.0354 | YES |
| K-1420 OU | CK | Lead | 52.2 | 24.6 | 66.2500 | 90.5177 | YES |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| K-1420 OU | CK | Lithium | 9.17 | 3.48 | 52.2000 | 228.3537 | YES |
| K-1420 OU | CK | Manganese | 3060 | 1170 | 470.0000 | 1960.0454 | NO |
| K-1420 OU | CK | Mercury | 0.1840 | 0.1300 | 0.2025 | 0.4301 | YES |
| K-1420 OU | CK | Nickel | 10.70 | 6.06 | 24.0500 | 33.8363 | YES |
| K-1420 OU | CK | Strontium | 7.68 | 3.33 | 38.2500 | 255.7587 | YES |
| K-1420 OU | CK | Thallium | 1.370 | NA | 0.7200 | NA | NO |
| K-1420 OU | CK | Vanadium | 39.4 | 26.4 | 48.9000 | 141.0808 | YES |
| K-1420 OU | CK | Zinc | 54.5 | 43.2 | 84.3500 | 154.1170 | YES |
| CR OU2 | CR, CK, CG, CHE | Aluminum | 18600 | 9510 | NA | 21900 | YES |
| CR OU2 | CR, CK, CG, CHE | Arsenic | 30.70 | 9.73 | NA | 131.0 | YES |
| CR OU2 | CR, CK, CG, CHE | Barium | 151.0 | 69.5 | NA | 450.0 | YES |
| CR OU2 | CR, CK, CG, CHE | Chromium | 38.5 | 15.0 | NA | 25.1 | NO |
| CR OU2 | CR, CK, CG, CHE | Copper | 20.6 | 5.26 | NA | 69.1 | YES |
| CR OU2 | CR, CK, CG, CHE | Lead | 52.2 | 24.6 | NA | 18.8 | NO |

**Table G.6 (continued)**

| LOCATION | FORMATION[a] | ANALYTE | BACKGROUND | | OU SOIL | | Retained[b]-Exceeds Background? |
|---|---|---|---|---|---|---|---|
| | | | 95% UCB HIGH | 95% UCB LOW | MEAN | 95% UCB | |
| CR OU2 | CR, CK, CG, CHE | Manganese | 3060 | 1710 | NA | 152.0 | NO |
| CR OU2 | CR, CK, CG, CHE | Mercury | 0.184 | 0.130 | NA | 0.705 | YES |
| CR OU2 | CR, CK, CG, CHE | Nickel | 16.70 | 6.06 | NA | 36.0 | YES |
| CR OU2 | CR, CK, CG, CHE | Selenium | 1.310 | 0.621 | NA | 14.8 | YES |
| CR OU2 | CR, CK, CG, CHE | Vanadium | 42.0 | 26.4 | NA | 84.9 | YES |
| CR OU2 | CR, CK, CG, CHE | Zinc | 55.5 | 43.2 | NA | 53.9 | NO |

NA= Not Available.
If data on formation of OU is not available, then the range of background levels in all formations was used for comparison.

[a] Formations and Groups: CHI = Chickamauga Group; C (R) = Conasauga Group (Remaining) = Dismal Gap Formation and Nolichucky Formation; CK = Knox Group = Copper Ridge Formation and Chepultepec Formation; MN = Maynardville; Formation; CK(R) = Knox Group Remaining; NL = Nolichucky Formation; CHE = Chepultepec Formation; DG = Dismal Gap Formation; CR = Copper Ridge Formation; R = Rome Formation

**Operable Units and Corresponding Formations or Groups:**
BCVOU1 = C(R), DG, NL, MN SCF = CHI
BCOU2 = MN, CR K1420 = CK
WAG 1 = C(R), DG K1407 = CR, CHI
WAG 6 = NL, DG LEFPC/UEFPC = CHI, CK, CK(R)
CR OU2 = CR, CK, CG, CHE

[b] Retained COPCs either exceed background or background values were not available for comparison.

[c] Cyanide background levels only available for Dismal Gap formation.

**Table G.7. Soil-plant uptake factors from collocated soil and plant samples collected from Lower East Fork Poplar Creek (SAIC 1994)**

| Analyte | Soil (mg/kg) | Foliage (mg/kg) | Uptake factor | Average uptake factor |
|---|---|---|---|---|
| Antimony | 0.4439 | 0.00122 | 0.0027 | 0.04 |
| Arsenic | 2.9215 | 0.0047 | 0.0016 | 0.004 |
| Cadmium | 0.4600 | 0.5806 | 1.2622 | 0.645 |
| Chromium | 28.809 | 1.0190 | 0.0354 | 0.041 |
| Mercury | 8.3102 | 0.2950 | 0.0355 | 0.143 |
| Selenium | 2.0139 | 0.0712 | 0.0354 | 0.033 |
| Zinc | 6.2234 | 9.4148 | 1.5128 | 0.3701 |
| Uranium | 8.3374 | 0.0755 | 0.0091 | 0.0063 |
| Antimony | 0.3720 | 0.0166 | 0.0446 | |
| Arsenic | 2.0655 | 0.0392 | 0.0190 | |
| Cadmium | 0.3560 | 0.5674 | 1.5938 | |
| Chromium | 25.778 | 3.480 | 0.1350 | |
| Mercury | 0.0593 | 0.1106 | 1.8651 | |
| Selenium | 1.3405 | 0.0833 | 0.0621 | |
| Zinc | 13.828 | 10.563 | 0.7639 | |
| Uranium | 4.3656 | 0.0730 | 0.0167 | |
| Antimony | 0.5533 | 0.0250 | 0.0452 | |
| Arsenic | 4.2834 | 0.0407 | 0.0095 | |
| Cadmium | 0.00 | 0.2017 | ERR | |
| Chromium | 28.925 | 1.1763 | 0.0407 | |
| Mercury | 64.407 | 1.4212 | 0.0221 | |
| Selenium | 2.1316 | 0.0709 | 0.0333 | |
| Zinc | 13.403 | 13.174 | 0.9829 | |
| Uranium | 17.625 | 0.2357 | 0.0134 | |
| Antimony | 1.2014 | 0.479 | 0.3987 | |

**Table G.7 (continued)**

| Analyte | Soil (mg/kg) | Foliage (mg/kg) | Uptake factor | Average uptake factor |
|---|---|---|---|---|
| Arsenic | 11.348 | 0.2244 | 0.0198 | |
| Cadmium | 0.00 | 0.00 | ERR | |
| Chromium | 74.619 | 5.0518 | 0.0677 | |
| Mercury | 459.04 | 10.559 | 0.0230 | |
| Selenium | 4.9966 | 0.1554 | 0.0311 | |
| Zinc | 46.411 | 9.9251 | 0.2139 | |
| Uranium | 43.546 | 1.5275 | 0.0351 | |
| | | | | |
| Antimony | 1.9831 | 0.0105 | 0.0053 | |
| Arsenic | 15.103 | 0.0134 | 0.0009 | |
| Cadmium | 0.4791 | 0.0480 | 0.1002 | |
| Chromium | 139.95 | 1.5751 | 0.0113 | |
| Mercury | 302.44 | 0.1176 | 0.0004 | |
| Selenium | 6.6564 | 0.0599 | 0.0090 | |
| Zinc | 0.00 | 11.459 | ERR | |
| Uranium | 128.83 | 0.0924 | 0.0007 | |
| | | | | |
| Antimony | 1.4792 | 0.0108 | 0.0073 | |
| Arsenic | 15.729 | 0.0284 | 0.0018 | |
| Cadmium | 0.00 | 0.2406 | ERR | |
| Chromium | 132.46 | 2.1597 | 0.0163 | |
| Mercury | 215.49 | 0.0901 | 0.0004 | |
| Selenium | 7.2919 | 0.0538 | 0.0074 | |
| Zinc | 276.39 | 27.298 | 0.0988 | |
| Uranium | 126.04 | 0.0715 | 0.0006 | |
| | | | | |
| Antimony | 0.4731 | 0.0080 | 0.0169 | |
| Arsenic | 5.0973 | 0.0056 | 0.0011 | |
| Cadmium | 0.00 | 0.0154 | ERR | |
| Chromium | 101.04 | 0.6662 | 0.0066 | |
| Mercury | 115.70 | 0.0680 | 0.0006 | |

**Table G.7 (continued)**

| Analyte | Soil (mg/kg) | Foliage (mg/kg) | Uptake factor | Average uptake factor |
|---|---|---|---|---|
| Selenium | 4.9574 | 0.0477 | 0.0096 | |
| Zinc | 171.66 | 4.021 | 0.0234 | |
| Uranium | 25.843 | 0.0391 | 0.0015 | |
| | | | | |
| Antimony | 0.7320 | 0.0061 | 0.0083 | |
| Arsenic | 10.253 | 0.00 | 0.0000 | |
| Cadmium | 0.00 | 0.0031 | ERR | |
| Chromium | 74.002 | 3.254 | 0.0440 | |
| Mercury | 156.12 | 0.0384 | 0.0002 | |
| Selenium | 2.8336 | 0.014 | 0.0049 | |
| Zinc | 157.86 | 7.783 | 0.0493 | |
| Uranium | 36.533 | 0.0413 | 0.0011 | |
| | | | | |
| Antimony | 0.9154 | 0.0062 | 0.0068 | |
| Arsenic | 7.2894 | 0.0110 | 0.0015 | |
| Cadmium | 0.00 | 0.0949 | ERR | |
| Chromium | 74.783 | 0.8638 | 0.0116 | |
| Mercury | 443.27 | 0.064 | 0.0001 | |
| Selenium | 2.6560 | 0.0186 | 0.0070 | |
| Zinc | 125.94 | 10.767 | 0.0855 | |
| Uranium | 33.524 | 0.0778 | 0.0023 | |
| | | | | |
| Antimony | 1.4493 | 0.0070 | 0.0048 | |
| Arsenic | 18.145 | 0.0039 | 0.0002 | |
| Cadmium | 0.00 | 0.2343 | ERR | |
| Chromium | 88.982 | 0.5460 | 0.0061 | |
| Mercury | 1043.5 | 0.1274 | 0.0001 | |
| Selenium | 8.0090 | 0.0200 | 0.0025 | |
| Zinc | 159.59 | 7.2600 | 0.0455 | |
| Uranium | 68.217 | 0.0211 | 0.0003 | |

**Table G.7 (continued)**

| Analyte | Soil (mg/kg) | Foliage (mg/kg) | Uptake factor | Average uptake factor |
|---|---|---|---|---|
| Antimony | 1.2713 | 0.0074 | 0.0058 | |
| Arsenic | 20.289 | 0.0118 | 0.0006 | |
| Cadmium | 0.00 | 0.0473 | ERR | |
| Chromium | 74.985 | 2.4308 | 0.0324 | |
| Mercury | 894.37 | 0.0992 | 0.0001 | |
| Selenium | 4.1923 | 0.0512 | 0.0122 | |
| Zinc | 136.04 | 6.8167 | 0.0501 | |
| Uranium | 58.647 | 0.0078 | 0.0001 | |
| | | | | |
| Antimony | 0.6456 | 0.0114 | 0.0177 | |
| Arsenic | 7.2085 | 0.00 | 0.0000 | |
| Cadmium | 0.00 | 0.2337 | ERR | |
| Chromium | 48.513 | 0.6256 | 0.0129 | |
| Mercury | 15.358 | 0.1953 | 0.0127 | |
| Selenium | 5.0364 | 0.0067 | 0.0013 | |
| Zinc | 0.00 | 14.986 | ERR | |
| Uranium | 16.070 | 0.0592 | 0.0037 | |
| | | | | |
| Antimony | 1.0175 | 0.0082 | 0.0081 | |
| Arsenic | 7.4064 | 0.0140 | 0.0019 | |
| Cadmium | 0.4957 | 0.0299 | 0.0603 | |
| Chromium | 52.997 | 4.0416 | 0.0763 | |
| Mercury | 6.7074 | 0.0998 | 0.0149 | |
| Selenium | 3.2376 | 0.0417 | 0.0129 | |
| Zinc | 98.463 | 14.254 | 0.1448 | |
| Uranium | 14.210 | 0.0453 | 0.0032 | |
| | | | | |
| Antimony | 0.8955 | 0.0143 | 0.0160 | |
| Arsenic | 11.190 | 0.0351 | 0.0031 | |
| Cadmium | 0.3930 | 0.1587 | 0.4038 | |
| Chromium | 36.128 | 2.0822 | 0.0576 | |

**Table G.7 (continued)**

| Analyte | Soil (mg/kg) | Foliage (mg/kg) | Uptake factor | Average uptake factor |
|---|---|---|---|---|
| Mercury | 2.8981 | 0.0774 | 0.0267 | |
| Selenium | 2.9368 | 0.6130 | 0.2087 | |
| Zinc | 72.808 | 8.3377 | 0.1145 | |
| Uranium | 7.3750 | 0.0509 | 0.0069 | |
| | | | | |
| Antimony | 0.6773 | 0.0116 | 0.0171 | |
| Arsenic | 10.997 | 0.0091 | 0.0008 | |
| Cadmium | 0.1590 | 0.0719 | 0.4522 | |
| Chromium | 26.298 | 1.5607 | 0.0593 | |
| Mercury | 0.00 | 0.0589 | ERR | |
| Selenium | 1.4524 | 0.0743 | 0.0512 | |
| Zinc | 13.815 | 10.023 | 0.7255 | |
| Uranium | 3.8349 | 0.00 | 0.0000 | |

**Table G.8. Soil-plant organic contaminant uptake factors using octanol water partition coefficients (Travis and Arms 1988)**

| Chemical | $K_{ow}$[a] | log $B_v$ | Soil-plant uptake factor |
|---|---|---|---|
| Acetone | -0.24 | 1.7267 | 53.297 |
| 4,4'DDT | 6.38 | -2.0996 | 0.00795 |
| 4,4'DDD | 5.9 | -1.8222 | 0.015059 |
| Benzo(a)pyrene | 6.1 | -1.9378 | 0.01154 |
| Bis(2ethylhexyl)phthalate | 9.6 | -3.9608 | 0.000109 |
| Chloroform | 2.0 | 0.432 | 2.704 |
| Di-N-Butylphtalate | 4.1 | -0.781 | 0.16558 |
| Dibenzofuran | 4.12 | -0.79336 | 0.16093 |
| Methylene Chloride | 1.3 | 0.8366 | 6.864 |
| PCBs-1221/1232/1242/1248/1260 | 7.14 | -2.5389 | 0.00289 |
| PCB-1254 | 6.03 | -1.897 | 0.01268 |
| Tetrachloroethylene/ethene | 3.4 | -0.3772 | 0.41957 |
| Toluene | 2.7 | 0.0274 | 1.0651 |
| Aldrin | 5.52[b] | -1.6026 | 0.02497 |
| Endrin | 4.92 | -1.25576 | 0.05549 |
| Heptachlor | 4.3 | -0.8974 | 0.12665 |
| Lindane (gamma BHC) | 3.72 | -0.56216 | 0.27406 |
| 1,2 Dichloroethylene | 1.90 | 0.4898 | 3.0889 |
| 1,1,1 Trichlorethane | 2.50 | 0.143 | 1.3899 |
| 1,2 Dichloroethane | 1.5 | 0.721 | 5.2602 |
| Trichloroethene/ethylene | 2.4 | 0.2008 | 1.5878 |
| Dieldrin | 5.34 | -1.4985 | 0.03173 |
| Diethylphthalate | 2.5 | 0.143 | 1.3899 |
| Chlordane | 5.5 | -1.591 | 0.025645 |
| Benzene | 2.1 | 0.3742 | 2.367 |
| Vinyl Chloride | 1.4 | 0.7788 | 6.00896 |

**Soil-Plant Uptake Factors calculated using the following equation: $\log B_v = 1.588 - 0.578 \log K_{ow}$**
Where:

$B_v$= Bioaccumulation factor for vegetation = soil-plant uptake factor
$K_{ow}$= Octanol Water Partitioning Coeffient.

[a] $K_{ow}$ Source: Hull and Suter 1994.

[b] $K_{ow}$ for Aldrin Source: Travis and Arms 1988.

**Table G.9. Soil-earthworm contaminant uptake factors for earthworms from WAG 5[a]**

| Analyte | Media | Mean (mg/kg) | Uptake factor | STD |
|---|---|---|---|---|
| Aluminum | soil | 16116.7 | 0.0317 | 0.0161 |
| | worm | 497.8 | | |
| Aroclor-1260 | soil | 0.19 | 7.1065 | 8.7613 |
| | worm | 1.6 | | |
| Arsenic | soil | 4.07 | 0.6322 | 0.2168 |
| | worm | 2.4 | | |
| Barium | soil | 159 | 0.0777 | 0.0319 |
| | worm | 12.3 | | |
| Beryllium | soil | 0.99 | 1.3052 | 0.1745 |
| | worm | 1.25 | | |
| Cadmium | soil | 0.070 | 4.8118 | 1.9357 |
| | worm | 3.5 | | |
| Chromium | soil | 31.07 | 0.2892 | 0.1208 |
| | worm | 8.7 | | |
| Mercury | soil | 0.52 | 5.7669 | 7.194 |
| | worm | 0.87 | | |
| Selenium | soil | 2.9 | 7.4157 | 8.9345 |
| | worm | 7.8 | | |
| Zinc | soil | 70.4 | 5.5897 | 1.477 |
| | worm | 371.8 | | |

[a] Uptake factor expressed as dry weight soil to dry weight earthworm.

## Table G.10. Total contaminant exposure and NOAEL HQs for white-tailed deer on the ORR

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| BCVOU1 | 4,4-DDE | 0.108 | NA | 0.1047 | 0.0113 | 0.0003 | 0.0001 | 0.0004 | 0.15 | 0.00 |
| BCVOU1 | 4,4-DDT | 0.108 | NA | 0.0080 | 0.0009 | 0.0000 | 0.0001 | 0.0001 | 0.15 | 0.00 |
| BCVOU1 | Acetone | 0.036 | 0.043 | 53.2970 | 2.3048 | 0.0710 | 0.0000 | 0.0710 | 1.9 | 0.04 |
| BCVOU1 | Antimony | 1.031 | 1.737 | 0.0400 | 0.0695 | 0.0021 | 0.0011 | 0.0032 | 0.01 | 0.32 |
| BCVOU1 | Arsenic | 9.269 | 13.352 | 0.0040 | 0.0534 | 0.0016 | 0.0082 | 0.0099 | 0.01 | 0.99 |
| BCVOU1 | Barium | 264.315 | 403.009 | 0.1500 | 60.4513 | 1.8617 | 0.2482 | 2.1099 | 1 | 2.11 |
| BCVOU1 | Benzo(a)pyrene | 10.811 | 19.901 | 0.0115 | 0.2297 | 0.0071 | 0.0123 | 0.0193 | 0.08 | 0.24 |
| BCVOU1 | Beryllium | 1.051 | 1.428 | 0.0100 | 0.0143 | 0.0004 | 0.0009 | 0.0013 | 0.12 | 0.01 |
| BCVOU1 | Bis(2-ethylhexyl) phthalate | 3.333 | 0.587 | 0.0001 | 0.0001 | 0.0000 | 0.0004 | 0.0004 | 1.5 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BCVOU1 | Cadmium | 5.380 | 10.736 | 0.6450 | 6.9250 | 0.2133 | 0.0066 | 0.2199 | 0.001 | 219.88 |
| BCVOU1 | Chloroform | 0.012 | NA | 2.7040 | 0.0315 | 0.0010 | 0.0000 | 0.0010 | 2.8 | 0.00 |
| BCVOU1 | Chromium | 48.977 | 68.364 | 0.0410 | 2.8029 | 0.0863 | 0.0421 | 0.1284 | 0.61 | 0.21 |
| BCVOU1 | Copper | 972.062 | 1779.997 | 0.4000 | 711.9989 | 21.9270 | 1.0964 | 23.0234 | 3.1 | 7.43 |
| BCVOU1 | Di-n-butylphthalate | 2.999 | 0.316 | 0.1656 | 0.0524 | 0.0016 | 0.0002 | 0.0018 | 46 | 0.00 |
| BCVOU1 | Lead | 287.462 | 543.246 | 0.0450 | 24.4461 | 0.7529 | 0.3346 | 1.0875 | 1.5 | 0.72 |
| BCVOU1 | Mercury | 18.982 | 31.842 | 0.1430 | 4.5534 | 0.1402 | 0.0196 | 0.1598 | 0.006 | 26.64 |
| BCVOU1 | Methylene chloride | 0.017 | 0.023 | 6.8640 | 0.1601 | 0.0049 | 0.0000 | 0.0049 | 1.09 | 0.00 |
| BCVOU1 | Molybdenum | 8.855 | 18.202 | NA | NA | NA | 0.0112 | 0.0112 | 0.02 | 0.56 |
| BCVOU1 | Nickel | 85.108 | 137.529 | 0.0600 | 8.2517 | 0.2541 | 0.0847 | 0.3388 | 7.5 | 0.05 |
| BCVOU1 | PCB-1254 | 1.790 | 2.665 | 0.0127 | 0.0338 | 0.0010 | 0.0016 | 0.0027 | 0.004 | 0.67 |

**Table G.10 (continued)**

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| BCVOU1 | PCB-1260 | 3.651 | 6.741 | 0.0029 | 0.0195 | 0.0006 | 0.0042 | 0.0048 | 0.004 | 1.19 |
| BCVOU1 | Selenium | 1.750 | 2.268 | 0.0330 | 0.0748 | 0.0023 | 0.0014 | 0.0037 | 0.006 | 0.62 |
| BCVOU1 | Tetrachloroethene | 0.012 | NA | 0.4196 | 0.0049 | 0.0002 | 0.0000 | 0.0002 | 0.1 | 0.00 |
| BCVOU1 | Tin | 20.523 | 34.428 | NA | NA | NA | 0.0212 | 0.0212 | 1.9 | 0.01 |
| BCVOU1 | Toluene | 0.314 | 0.399 | 1.0651 | 0.4252 | 0.0131 | 0.0002 | 0.0133 | 2.2 | 0.01 |
| BCVOU1 | Zinc | 668.908 | 1133.306 | 0.3701 | 419.4366 | 12.9172 | 0.6980 | 13.6152 | 30 | 0.45 |
| LEFPC | 4,4-DDD | 0.017 | 0.001 | 0.0151 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| LEFPC | 4,4-DDE | 0.015 | 0.002 | 0.1047 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| LEFPC | 4,4-DDT | 0.017 | 0.001 | 0.0080 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| LEFPC | Acetone | 0.254 | 0.577 | 53.2970 | 30.7414 | 0.9467 | 0.0004 | 0.9471 | 1.9 | 0.50 |
| LEFPC | Aldrin | 0.008 | 0.000 | 0.0250 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.04 | 0.00 |
| LEFPC | Antimony | 1.284 | 0.787 | 0.0400 | 0.0315 | 0.0010 | 0.0005 | 0.0015 | 0.01 | 0.15 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | Barium | 121.357 | 130.047 | 0.1500 | 19.5071 | 0.6007 | 0.0801 | 0.6808 | 1 | 0.68 |
| LEFPC | Benzo(a)pyrene | 0.492 | 0.484 | 0.0115 | 0.0056 | 0.0002 | 0.0003 | 0.0005 | 0.08 | 0.01 |
| LEFPC | Bis(2-ethylhexyl) phthalate | 0.334 | 0.201 | 0.0001 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 1.5 | 0.00 |
| LEFPC | Cadmium | 4.089 | 4.645 | 0.6450 | 2.9957 | 0.0923 | 0.0029 | 0.0951 | 0.001 | 95.12 |
| LEFPC | Chromium | 64.608 | 65.531 | 0.0410 | 2.6868 | 0.0827 | 0.0404 | 0.1231 | 0.61 | 0.20 |
| LEFPC | Copper | 78.033 | 89.671 | 0.4000 | 35.8685 | 1.1046 | 0.0552 | 1.1599 | 3.1 | 0.37 |
| LEFPC | Cyanide | 3.024 | 5.824 | NA | NA | NA | 0.0036 | 0.0036 | 11.8 | 0.00 |
| LEFPC | Di-n-butlyphthalate | 0.421 | 0.184 | 0.1656 | 0.0305 | 0.0009 | 0.0001 | 0.0011 | 46 | 0.00 |
| LEFPC | Dieldrin | 0.017 | 0.002 | 0.0317 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.00 |
| LEFPC | Diethylphthalate | 0.461 | 0.173 | 1.3899 | 0.2409 | 0.0074 | 0.0001 | 0.0075 | 381 | 0.00 |
| LEFPC | Endosulfan I | 0.008 | 0.001 | NA | NA | NA | 0.0000 | 0.0000 | 0.03 | 0.00 |
| LEFPC | Endosulfan II | 0.017 | 0.001 | NA | NA | NA | 0.0000 | 0.0000 | 0.03 | 0.00 |
| LEFPC | Endrin | 0.017 | 0.001 | 0.0555 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.008 | 0.00 |
| LEFPC | Heptachlor | 0.008 | 0.000 | 0.1267 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.03 | 0.00 |
| LEFPC | Lead | 53.799 | 61.485 | 0.0450 | 2.7668 | 0.0852 | 0.0379 | 0.1231 | 1.5 | 0.08 |
| LEFPC | Lindane | 0.008 | 0.001 | 0.2741 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 1.5 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | Mercury | 38.488 | 41.609 | 0.1430 | 5.9501 | 0.1832 | 0.0256 | 0.2089 | 0.006 | 34.81 |
| LEFPC | Methoxychlor | 0.083 | 0.006 | NA | NA | NA | 0.0000 | 0.0000 | 0.7 | 0.00 |
| LEFPC | Methylene chloride | 0.037 | 0.053 | 6.8640 | 0.3634 | 0.0112 | 0.0000 | 0.0112 | 1.09 | 0.01 |
| LEFPC | Nickel | 34.367 | 37.906 | 0.0600 | 2.2744 | 0.0700 | 0.0233 | 0.0934 | 7.5 | 0.01 |
| LEFPC | PCB-1016 | 0.090 | 0.050 | NA | NA | NA | 0.0000 | 0.0000 | 0.36 | 0.00 |
| LEFPC | PCB-1242 | 0.090 | 0.050 | 0.0029 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.018 | 0.00 |
| LEFPC | PCB-1248 | 0.090 | 0.050 | 0.0029 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0 | 0.00 |
| LEFPC | PCB-1254 | 0.258 | 0.224 | 0.0127 | 0.0028 | 0.0001 | 0.0001 | 0.0002 | 0.004 | 0.06 |
| LEFPC | PCB-1260 | 0.431 | 0.465 | 0.0029 | 0.0013 | 0.0000 | 0.0003 | 0.0003 | 0.004 | 0.08 |
| LEFPC | Pentachlorophenol | 1.692 | 0.377 | NA | NA | NA | 0.0002 | 0.0002 | 0.04 | 0.01 |
| LEFPC | Selenium | 13.566 | 8.704 | 0.0330 | 0.2872 | 0.0088 | 0.0054 | 0.0142 | 0.006 | 2.37 |
| LEFPC | Thallium | 0.809 | NA | NA | NA | NA | 0.0005 | 0.0005 | 0.001 | 0.50 |
| LEFPC | Uranium | 9.708 | 11.895 | 0.0063 | 0.0749 | 0.0023 | 0.0073 | 0.0096 | 0.25 | 0.04 |
| LEFPC | Zinc | 179.913 | 166.199 | 0.3701 | 61.5103 | 1.8943 | 0.1024 | 1.9967 | 30 | 0.07 |
| LEFPC | Alpha-chlordane | 0.073 | 0.003 | 0.0257 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| LEFPC | Delta-BHC | 0.008 | 0.000 | 0.4340 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.3 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | Gamma-chlordane | 0.073 | 0.001 | 0.0257 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| K-1407 OU | 1,1,1-trichlorethane | 0.015 | NA | 1.3899 | 0.0215 | 0.0007 | 0.0000 | 0.0007 | 87 | 0.00 |
| K-1407 OU | 1,2-Dichlorethene | 0.017 | 0.028 | 3.0889 | 0.0856 | 0.0026 | 0.0000 | 0.0027 | 3.8 | 0.00 |
| K-1407 OU | Acetone | 0.028 | 0.019 | 53.2970 | 1.0007 | 0.0308 | 0.0000 | 0.0308 | 1.9 | 0.02 |
| K-1407 OU | Aluminum | 26562.963 | 28723.527 | 0.0040 | 114.8941 | 3.5383 | 17.6917 | 21.2300 | 0.16 | 132.69 |
| K-1407 OU | Antimony | 7.151 | NA | 0.0400 | 0.2860 | 0.0088 | 0.0044 | 0.0132 | 0.01 | 1.32 |
| K-1407 OU | Arsenic | 12.433 | 13.068 | 0.0040 | 0.0523 | 0.0016 | 0.0080 | 0.0097 | 0.01 | 0.97 |
| K-1407 OU | Barium | 110.494 | 125.275 | 0.1500 | 18.7913 | 0.5787 | 0.0772 | 0.6559 | 1 | 0.66 |
| K-1407 OU | Beryllium | 1.016 | 1.127 | 0.0100 | 0.0113 | 0.0003 | 0.0007 | 0.0010 | 0.12 | 0.01 |
| K-1407 OU | Boron | 6.419 | 8.400 | NA | NA | NA | 0.0052 | 0.0052 | 5.2 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1407 OU | Cadmium | 1.880 | 2.149 | 0.6450 | 1.3863 | 0.0427 | 0.0013 | 0.0440 | 0.001 | 44.02 |
| K-1407 OU | Chloroform | 0.016 | 0.012 | 2.7040 | 0.0322 | 0.0010 | 0.0000 | 0.0010 | 2.8 | 0.00 |
| K-1407 OU | Chromium | 61.037 | 69.864 | 0.0410 | 2.8644 | 0.0882 | 0.0430 | 0.1312 | 0.61 | 0.22 |
| K-1407 OU | Copper | 40.854 | 48.640 | 0.4000 | 19.4559 | 0.5992 | 0.0300 | 0.6291 | 3.1 | 0.20 |
| K-1407 OU | Di-n-butylphthalate | 0.017 | 0.018 | 0.1656 | 0.0031 | 0.0001 | 0.0000 | 0.0001 | 46 | 0.00 |
| K-1407 OU | Lead | 30.675 | 32.996 | 0.0450 | 1.4848 | 0.0457 | 0.0203 | 0.0661 | 1.5 | 0.04 |
| K-1407 OU | Mercury | 4.725 | 6.396 | 0.1430 | 0.9147 | 0.0282 | 0.0039 | 0.0321 | 0.006 | 5.35 |
| K-1407 OU | Methylene chloride | 0.018 | 0.021 | 6.8640 | 0.1457 | 0.0045 | 0.0000 | 0.0045 | 1.09 | 0.00 |
| K-1407 OU | Nickel | 192.179 | 251.090 | 0.0600 | 15.0654 | 0.4640 | 0.1547 | 0.6186 | 7.5 | 0.08 |
| K-1407 OU | Selenium | 7.152 | NA | 0.0330 | 0.2360 | 0.0073 | 0.0044 | 0.0117 | 0.006 | 1.95 |
| K-1407 OU | Strontium | 18.142 | 20.670 | NA | NA | NA | 0.0127 | 0.0127 | 49 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1407 OU | Tetrachloroethene | 0.023 | 0.024 | 0.4196 | 0.0102 | 0.0003 | 0.0000 | 0.0003 | 0.1 | 0.00 |
| K-1407 OU | Toluene | 0.011 | 0.001 | 1.0651 | 0.0011 | 0.0000 | 0.0000 | 0.0000 | 2.2 | 0.00 |
| K-1407 OU | Trichloroethene | 0.025 | 0.028 | 1.5878 | 0.0446 | 0.0014 | 0.0000 | 0.0014 | 0.06 | 0.02 |
| K-1407 OU | Uranium | 143.694 | 255.850 | 0.0063 | 1.6119 | 0.0496 | 0.1576 | 0.2072 | 0.25 | 0.83 |
| K-1407 OU | Zinc | 59.778 | 64.471 | 0.3701 | 23.8607 | 0.7348 | 0.0397 | 0.7745 | 30 | 0.03 |
| WAG 1 | 1,1,1-trichlorethane | 0.008 | 0.003 | 1.3899 | 0.0045 | 0.0001 | 0.0000 | 0.0001 | 87 | 0.00 |
| WAG 1 | 1,1-Dichlorethene | 0.008 | 0.006 | NA | NA | NA | 0.0000 | 0.0000 | 5.6 | 0.00 |
| WAG 1 | 1,2-Dichlorethane | 0.008 | 0.006 | 5.2602 | 0.0316 | 0.0010 | 0.0000 | 0.0010 | 4 | 0.00 |
| WAG 1 | 1,2-Dichlorethene | 0.008 | 0.002 | 3.0889 | 0.0070 | 0.0002 | 0.0000 | 0.0002 | 3.8 | 0.00 |
| WAG 1 | 4,4-DDD | 0.021 | NA | 0.0151 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| WAG 1 | 4,4-DDE | 0.022 | NA | 0.1047 | 0.0023 | 0.0001 | 0.0000 | 0.0001 | 0.15 | 0.00 |
| WAG 1 | 4,4-DDT | 0.021 | 0.010 | 0.0080 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| WAG 1 | Acetone | 0.028 | 0.029 | 53.2970 | 1.5641 | 0.0482 | 0.0000 | 0.0482 | 1.9 | 0.03 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Antimony | 6.127 | 6.062 | 0.0400 | 0.2425 | 0.0075 | 0.0037 | 0.0112 | 0.01 | 1.12 |
| WAG 1 | Arsenic | 9.012 | 9.769 | 0.0040 | 0.0391 | 0.0012 | 0.0060 | 0.0072 | 0.01 | 0.72 |
| WAG 1 | Benzene | 0.008 | 0.003 | 2.3670 | 0.0074 | 0.0002 | 0.0000 | 0.0002 | 2.19 | 0.00 |
| WAG 1 | Benzo(a)pyrene | 0.678 | 0.726 | 0.0115 | 0.0084 | 0.0003 | 0.0004 | 0.0007 | 0.08 | 0.01 |
| WAG 1 | Beryllium | 0.949 | 1.013 | 0.0100 | 0.0101 | 0.0003 | 0.0006 | 0.0009 | 0.12 | 0.01 |
| WAG 1 | Bis(2-ethylhexyl) phthalate | 0.458 | 0.441 | 0.0001 | 0.0000 | 0.0000 | 0.0003 | 0.0003 | 1.5 | 0.00 |
| WAG 1 | Boron | 1204.965 | 1761.234 | NA | NA | NA | 1.0848 | 1.0848 | 5.2 | 0.21 |
| WAG 1 | Cadmium | 1.770 | 1.962 | 0.6450 | 1.2654 | 0.0390 | 0.0012 | 0.0402 | 0.001 | 40.18 |
| WAG 1 | Carbon tetrachloride | 0.008 | 0.006 | 0.9324 | 0.0056 | 0.0002 | 0.0000 | 0.0002 | 3 | 0.00 |
| WAG 1 | Chloroform | 0.010 | 0.009 | 2.7040 | 0.0244 | 0.0008 | 0.0000 | 0.0008 | 2.8 | 0.00 |
| WAG 1 | Chromium | 28.951 | 32.958 | 0.0410 | 1.3513 | 0.0416 | 0.0203 | 0.0619 | 0.61 | 0.10 |
| WAG 1 | Copper | 19.625 | 22.256 | 0.4000 | 8.9025 | 0.2742 | 0.0137 | 0.2879 | 3.1 | 0.09 |
| WAG 1 | Cyanide | 4.681 | NA | NA | NA | NA | 0.0029 | 0.0029 | 11.8 | 0.00 |
| WAG 1 | Di-n-butlyphthalate | 0.720 | 0.700 | 0.1656 | 0.1160 | 0.0036 | 0.0004 | 0.0040 | 46 | 0.00 |
| WAG 1 | Diethylphthalate | 0.579 | 0.048 | 1.3899 | 0.0668 | 0.0021 | 0.0000 | 0.0021 | 381 | 0.00 |

**Table G.10 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Endrin | 0.021 | NA | 0.0545 | 0.0011 | 0.0000 | 0.0000 | 0.0000 | 0.008 | 0.01 |
| WAG 1 | Heptachlor | 0.011 | NA | 0.1267 | 0.0013 | 0.0000 | 0.0000 | 0.0000 | 0.03 | 0.00 |
| WAG 1 | Lead | 40.874 | 46.324 | 0.0450 | 2.0846 | 0.0642 | 0.0285 | 0.0927 | 1.5 | 0.06 |
| WAG 1 | Mercury | 1.306 | 1.850 | 0.1430 | 0.2645 | 0.0081 | 0.0011 | 0.0093 | 0.006 | 1.55 |
| WAG 1 | Methylene chloride | 0.031 | 0.037 | 6.8640 | 0.2516 | 0.0077 | 0.0000 | 0.0078 | 1.09 | 0.01 |
| WAG 1 | PCB-1254 | 0.350 | 0.440 | 0.0127 | 0.0056 | 0.0002 | 0.0003 | 0.0004 | 0.004 | 0.11 |
| WAG 1 | PCB-1260 | 0.247 | 0.227 | 0.0029 | 0.0007 | 0.0000 | 0.0001 | 0.0002 | 0.004 | 0.04 |
| WAG 1 | Pentachlorophenol | 2.957 | 0.280 | NA | NA | NA | 0.0002 | 0.0002 | 0.04 | 0.00 |
| WAG 1 | Selenium | 14.565 | 16.841 | 0.0330 | 0.5558 | 0.0171 | 0.0104 | 0.0275 | 0.006 | 4.58 |
| WAG 1 | Tetrachloroethene | 0.008 | 0.004 | 0.4196 | 0.0018 | 0.0001 | 0.0000 | 0.0001 | 0.1 | 0.00 |
| WAG 1 | Thallium | 14.168 | 15.851 | NA | NA | NA | 0.0098 | 0.0098 | 0.001 | 9.76 |
| WAG 1 | Tin | 50.730 | 54.202 | NA | NA | NA | 0.0334 | 0.0334 | 1.9 | 0.02 |
| WAG 1 | Toluene | 0.007 | 0.004 | 1.0651 | 0.0038 | 0.0001 | 0.0000 | 0.0001 | 2.2 | 0.00 |
| WAG 1 | Trichloroethene | 0.007 | 0.002 | 1.5878 | 0.0036 | 0.0001 | 0.0000 | 0.0001 | 0.06 | 0.00 |
| WAG 1 | Uranium | 7.957 | 14.470 | 0.0063 | 0.0912 | 0.0028 | 0.0089 | 0.0117 | 0.25 | 0.05 |
| WAG 1 | Vinyl chloride | 0.015 | 0.012 | 6.0089 | 0.0723 | 0.0022 | 0.0000 | 0.0022 | 0.03 | 0.07 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Zinc | 91.993 | 105.628 | 0.3701 | 39.0929 | 1.2039 | 0.0651 | 1.2690 | 30 | 0.04 |
| WAG 1 | Alpha-BHC | 0.012 | NA | 0.4340 | 0.0051 | 0.0002 | 0.0000 | 0.0002 | 0.3 | 0.00 |
| WAG 1 | Alpha-chlordane | 0.105 | NA | 0.0256 | 0.0027 | 0.0001 | 0.0001 | 0.0001 | 0.4 | 0.00 |
| WAG 1 | Gamma-chlordane | 0.104 | NA | 0.0256 | 0.0027 | 0.0001 | 0.0001 | 0.0001 | 0.4 | 0.00 |
| WAG 6 | 1,2-Dichlorethene | 0.007 | NA | 3.0889 | 0.0209 | 0.0006 | 0.0000 | 0.0006 | 3.8 | 0.00 |
| WAG 6 | 1,4-Dioxane | 6.675 | 7.559 | NA | NA | NA | 0.0047 | 0.0047 | 0.1 | 0.05 |
| WAG 6 | Acetone | 0.014 | 0.015 | 53.2970 | 0.7822 | 0.0241 | 0.0000 | 0.0241 | 1.9 | 0.01 |
| WAG 6 | Barium | 132.813 | 143.471 | 0.1500 | 21.5206 | 0.6628 | 0.0884 | 0.7511 | 1 | 0.75 |
| WAG 6 | Beryllium | 1.383 | 1.486 | 0.0100 | 0.0149 | 0.0005 | 0.0009 | 0.0014 | 0.12 | 0.01 |
| WAG 6 | Bis(2-ethylhexyl) phthalate | 0.398 | 0.462 | 0.0001 | 0.0001 | 0.0000 | 0.0003 | 0.0003 | 1.5 | 0.00 |
| WAG 6 | Cadmium | 2.501 | 2.846 | 0.6450 | 1.8354 | 0.0565 | 0.0018 | 0.0583 | 0.001 | 58.28 |
| WAG 6 | Chloroform | 0.011 | 0.013 | 2.7040 | 0.0346 | 0.0011 | 0.0000 | 0.0011 | 2.8 | 0.00 |
| WAG 6 | Cyanide | 23.817 | NA | NA | NA | NA | 0.0147 | 0.0147 | 11.8 | 0.00 |
| WAG 6 | Methylene chloride | 0.028 | 0.038 | 6.8640 | 0.2595 | 0.0080 | 0.0000 | 0.0080 | 1.09 | 0.01 |
| WAG 6 | Nickel | 38.284 | 41.626 | 0.0600 | 2.4975 | 0.0769 | 0.0256 | 0.1026 | 7.5 | 0.01 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 6 | Tetrachloroethene | 0.006 | 0.003 | 0.4196 | 0.0014 | 0.0000 | 0.0000 | 0.0000 | 0.1 | 0.00 |
| WAG 6 | Tin | 55.025 | 89.243 | NA | NA | NA | 0.0550 | 0.0550 | 1.9 | 0.03 |
| WAG 6 | Toluene | 0.004 | 0.002 | 1.0651 | 0.0026 | 0.0001 | 0.0000 | 0.0001 | 2.2 | 0.00 |
| WAG 6 | Trichloroethene | 0.005 | 0.004 | 1.5878 | 0.0057 | 0.0002 | 0.0000 | 0.0002 | 0.06 | 0.00 |
| WAG 6 | Uranium | 0.818 | 1.007 | 0.0063 | 0.0063 | 0.0002 | 0.0006 | 0.0008 | 0.25 | 0.00 |
| UEFPC OU 2 | Aluminum | 29900.000 | 65257.008 | 0.0040 | 261.0280 | 8.0387 | 40.1937 | 48.2324 | 0.16 | 301.45 |
| UEFPC OU 2 | Barium | 149.850 | 567.505 | 0.1500 | 85.1257 | 2.6216 | 0.3495 | 2.9711 | 1 | 2.97 |
| UEFPC OU 2 | Beryllium | 1.250 | 2.197 | 0.0100 | 0.0220 | 0.0007 | 0.0014 | 0.0020 | 0.12 | 0.02 |
| UEFPC OU 2 | Chromium | 39.700 | 76.951 | 0.0410 | 3.1550 | 0.0972 | 0.0474 | 0.1446 | 0.61 | 0.24 |
| UEFPC OU 2 | Copper | 22.100 | 54.932 | 0.4000 | 21.9726 | 0.6767 | 0.0338 | 0.7105 | 3.1 | 0.23 |
| UEFPC OU 2 | Lead | 36.600 | 250.005 | 0.0450 | 11.2502 | 0.3465 | 0.1540 | 0.5005 | 1.5 | 0.33 |
| UEFPC OU 2 | Lithium | 22.700 | 31.539 | NA | NA | NA | 0.0194 | 0.0194 | 1.8 | 0.01 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| UEFPC OU 2 | Manganese | 484.000 | 2592.793 | 0.2500 | 648.1983 | 19.9622 | 1.5970 | 21.5592 | 16 | 1.35 |
| UEFPC OU 2 | Nickel | 36.200 | 57.035 | 0.0600 | 3.4221 | 0.1054 | 0.0351 | 0.1405 | 7.5 | 0.02 |
| UEFPC OU 2 | Nitrate | 0.585 | 1.122 | NA | NA | NA | 0.0007 | 0.0007 | 127 | 0.00 |
| UEFPC OU 2 | Strontium | 21.100 | 117.700 | NA | NA | NA | 0.0725 | 0.0725 | 49 | 0.00 |
| UEFPC OU 2 | Uranium | 1.565 | 6.206 | 0.0063 | 0.0391 | 0.0012 | 0.0038 | 0.0050 | 0.25 | 0.02 |
| UEFPC OU 2 | Zinc | 86.200 | 286.977 | 0.3701 | 106.2103 | 3.2709 | 0.1768 | 3.4477 | 30 | 0.11 |
| BC OU 2 | 1,1,1-trichlorethane | 0.008 | 0.008 | 1.3899 | 0.0113 | 0.0003 | 0.0000 | 0.0004 | 87 | 0.00 |
| BC OU 2 | 1,1-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.0000 | 0.0000 | 5.6 | 0.00 |
| BC OU 2 | 1,2-Dichlorethane | 0.008 | 0.008 | 5.2602 | 0.0426 | 0.0013 | 0.0000 | 0.0013 | 4 | 0.00 |
| BC OU 2 | 1,2-Dichlorethene | 0.008 | 0.008 | 3.0889 | 0.0250 | 0.0008 | 0.0000 | 0.0008 | 3.8 | 0.00 |
| BC OU 2 | 4,4-DDD | 0.005 | 0.006 | 0.0151 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| BC OU 2 | 4,4-DDE | 0.005 | 0.006 | 0.1047 | 0.0006 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |

**Table G.10 (continued)**

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| BC OU 2 | 4,4-DDT | 0.005 | 0.006 | 0.0080 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| BC OU 2 | Acetone | 0.051 | 0.105 | 53.2970 | 5.6010 | 0.1725 | 0.0001 | 0.1726 | 1.9 | 0.09 |
| BC OU 2 | Aldrin | 0.003 | 0.003 | 0.0250 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.04 | 0.00 |
| BC OU 2 | Aluminum | 26143.846 | 35920.340 | 0.0040 | 143.6814 | 4.4249 | 22.1244 | 26.5493 | 0.16 | 165.93 |
| BC OU 2 | Antimony | 0.309 | 0.357 | 0.0400 | 0.0143 | 0.0004 | 0.0002 | 0.0007 | 0.01 | 0.07 |
| BC OU 2 | Arsenic | 33.369 | 35.093 | 0.0040 | 0.1404 | 0.0043 | 0.0216 | 0.0259 | 0.01 | 2.59 |
| BC OU 2 | Barium | 101.400 | 153.978 | 0.1500 | 23.0967 | 0.7113 | 0.0948 | 0.8061 | 1 | 0.81 |
| BC OU 2 | Benzene | 0.008 | 0.008 | 2.3670 | 0.0192 | 0.0006 | 0.0000 | 0.0006 | 2.19 | 0.00 |
| BC OU 2 | Benzo(a)pyrene | 0.499 | 0.529 | 0.0115 | 0.0061 | 0.0002 | 0.0003 | 0.0005 | 0.08 | 0.01 |
| BC OU 2 | Beryllium | 1.025 | 1.315 | 0.0100 | 0.0132 | 0.0004 | 0.0008 | 0.0012 | 0.12 | 0.01 |
| BC OU 2 | Bis(2-ethylhexyl) phthalate | 0.499 | 0.529 | 0.0001 | 0.0001 | 0.0000 | 0.0003 | 0.0003 | 1.5 | 0.00 |
| BC OU 2 | Boron | 65.500 | 79.406 | NA | NA | NA | 0.0489 | 0.0489 | 5.2 | 0.01 |
| BC OU 2 | Cadmium | 1.247 | 0.857 | 0.6450 | 0.5529 | 0.0170 | 0.0005 | 0.0176 | 0.001 | 17.55 |
| BC OU 2 | Carbon tetrachloride | 0.008 | 0.008 | 0.9324 | 0.0076 | 0.0002 | 0.0000 | 0.0002 | 3 | 0.00 |
| BC OU 2 | Chloroform | 0.008 | 0.008 | 2.7040 | 0.0219 | 0.0007 | 0.0000 | 0.0007 | 2.8 | 0.00 |

**Table G.10 (continued)**

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| BC OU 2 | Chromium | 37.331 | 44.232 | 0.0410 | 1.8135 | 0.0559 | 0.0272 | 0.0831 | 0.61 | 0.14 |
| BC OU 2 | Copper | 39.223 | 57.365 | 0.4000 | 22.9461 | 0.7067 | 0.0353 | 0.7420 | 3.1 | 0.24 |
| BC OU 2 | Di-n-butlyphthalate | 0.499 | 0.529 | 0.1656 | 0.0876 | 0.0027 | 0.0003 | 0.0030 | 46 | 0.00 |
| BC OU 2 | Dieldrin | 0.005 | 0.006 | 0.0317 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.00 |
| BC OU 2 | Diethylphthalate | 0.499 | 0.529 | 1.3899 | 0.7353 | 0.0226 | 0.0003 | 0.0230 | 381 | 0.00 |
| BC OU 2 | Endosulfan I | 0.003 | 0.003 | NA | NA | NA | 0.0000 | 0.0000 | 0.03 | 0.00 |
| BC OU 2 | Endosulfan II | 0.005 | 0.006 | NA | NA | NA | 0.0000 | 0.0000 | 0.03 | 0.00 |
| BC OU 2 | Endrin | 0.005 | 0.006 | 0.0555 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.008 | 0.00 |
| BC OU 2 | Heptachlor | 0.003 | 0.003 | 0.1267 | 0.0004 | 0.0000 | 0.0000 | 0.0000 | 0.03 | 0.00 |
| BC OU 2 | Lead | 81.015 | 126.822 | 0.0450 | 5.7070 | 0.1758 | 0.0781 | 0.2539 | 1.5 | 0.17 |
| BC OU 2 | Lindane | 0.003 | 0.003 | 0.2741 | 0.0008 | 0.0000 | 0.0000 | 0.0000 | 1.5 | 0.00 |
| BC OU 2 | Lithium | 39.250 | 47.194 | NA | NA | NA | 0.0291 | 0.0291 | 1.8 | 0.02 |
| BC OU 2 | Manganese | 1021.523 | 1779.367 | 0.2500 | 444.8418 | 13.6996 | 1.0960 | 14.7955 | 16 | 0.92 |
| BC OU 2 | Mercury | 49.019 | 76.055 | 0.1430 | 10.8759 | 0.3349 | 0.0468 | 0.3818 | 0.006 | 63.63 |
| BC OU 2 | Methoxychlor | 0.026 | 0.028 | NA | NA | NA | 0.0000 | 0.0000 | 0.7 | 0.00 |
| BC OU 2 | Methylene chloride | 0.016 | 0.018 | 6.8640 | 0.1231 | 0.0038 | 0.0000 | 0.0038 | 1.09 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Nickel | 32.600 | 50.322 | 0.0600 | 3.0193 | 0.0930 | 0.0310 | 0.1240 | 7.5 | 0.02 |
| BC OU 2 | Niobium | 9.850 | NA | NA | NA | NA | 0.0061 | 0.0061 | 0.013 | 0.47 |
| BC OU 2 | PCB-1016 | 0.052 | 0.056 | NA | NA | NA | 0.0000 | 0.0000 | 0.36 | 0.00 |
| BC OU 2 | PCB-1242 | 0.052 | 0.056 | 0.0029 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.018 | 0.00 |
| BC OU 2 | PCB-1248 | 0.052 | 0.056 | 0.0029 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0 | ERR |
| BC OU 2 | PCB-1254 | 0.052 | 0.056 | 0.0127 | 0.0007 | 0.0000 | 0.0000 | 0.0001 | 0.004 | 0.01 |
| BC OU 2 | PCB-1260 | 0.042 | 0.048 | 0.0029 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.01 |
| BC OU 2 | Pentachlorophenol | 1.211 | 1.296 | NA | NA | NA | 0.0008 | 0.0008 | 0.04 | 0.02 |
| BC OU 2 | Selenium | 1.094 | 1.788 | 0.0330 | 0.0590 | 0.0018 | 0.0011 | 0.0029 | 0.006 | 0.49 |
| BC OU 2 | Strontium | 109.925 | 133.870 | NA | NA | NA | 0.0825 | 0.0825 | 49 | 0.00 |
| BC OU 2 | Tetrachloroethene | 0.007 | 0.008 | 0.4196 | 0.0033 | 0.0001 | 0.0000 | 0.0001 | 0.1 | 0.00 |
| BC OU 2 | Toluene | 0.008 | 0.008 | 1.0651 | 0.0086 | 0.0003 | 0.0000 | 0.0003 | 2.2 | 0.00 |
| BC OU 2 | Toxaphene | 0.261 | 0.284 | NA | NA | NA | 0.0002 | 0.0002 | 1.5 | 0.00 |
| BC OU 2 | Trichloroethene | 0.008 | 0.008 | 1.5878 | 0.0129 | 0.0004 | 0.0000 | 0.0004 | 0.06 | 0.01 |
| BC OU 2 | Uranium | 2.041 | 2.517 | 0.0063 | 0.0159 | 0.0005 | 0.0016 | 0.0020 | 0.25 | 0.01 |
| BC OU 2 | Vanadium | 54.838 | 62.578 | 0.0060 | 0.3755 | 0.0116 | 0.0385 | 0.0501 | 0.04 | 1.25 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Vinyl chloride | 0.015 | 0.016 | 6.0089 | 0.0974 | 0.0030 | 0.0000 | 0.0030 | 0.03 | 0.10 |
| BC OU 2 | Zinc | 113.208 | 149.418 | 0.3701 | 55.2996 | 1.7030 | 0.0920 | 1.7951 | 30 | 0.06 |
| BC OU 2 | Zirconium | 59.250 | 74.483 | NA | NA | NA | 0.0459 | 0.0459 | 0.14 | 0.33 |
| BC OU 2 | Alpha-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | 0.3 | 0.00 |
| BC OU 2 | Alpha-chlordane | 0.003 | 0.003 | 0.0256 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| BC OU 2 | Beta-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | 0.1 | 0.00 |
| BC OU 2 | Delta-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | 0.3 | 0.00 |
| BC OU 2 | Gamma-chlordane | 0.003 | 0.003 | 0.0256 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| SCF | 1,1,1-trichlorethane | 0.436 | 0.955 | 1.3899 | 1.3273 | 0.0409 | 0.0006 | 0.0415 | 87 | 0.00 |
| SCF | 1,1-Dichlorethene | 10.464 | 19.679 | NA | NA | NA | 0.0121 | 0.0121 | 5.6 | 0.00 |
| SCF | 1,2-Dichlorethane | 60.893 | 157.216 | 5.2602 | 826.9877 | 25.4683 | 0.0968 | 25.5651 | 4 | 6.39 |
| SCF | 4,4-DDD | 0.005 | 0.001 | 0.0151 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| SCF | 4,4-DDE | 0.003 | 0.002 | 0.1047 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| SCF | 4,4-DDT | 0.006 | 0.006 | 0.0080 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.15 | 0.00 |
| SCF | Acetone | 97.955 | 212.986 | 53.2970 | 11351.5129 | 349.5864 | 0.1312 | 349.7176 | 1.9 | 184.06 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| SCF | Aldrin | 0.003 | 0.000 | 0.0250 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.04 | 0.00 |
| SCF | Aluminum | 16294.045 | 20546.940 | 0.0040 | 82.1878 | 2.5311 | 12.6555 | 15.1866 | 0.16 | 94.92 |
| SCF | Antimony | 3.125 | 1.215 | 0.0400 | 0.0486 | 0.0015 | 0.0007 | 0.0022 | 0.01 | 0.22 |
| SCF | Arsenic | 12.771 | 14.534 | 0.0040 | 0.0581 | 0.0018 | 0.0090 | 0.0107 | 0.01 | 1.07 |
| SCF | Barium | 111.605 | 139.739 | 0.1500 | 20.9608 | 0.6455 | 0.0861 | 0.7316 | 1 | 0.73 |
| SCF | Benzene | 0.916 | 2.040 | 2.3670 | 4.8287 | 0.1487 | 0.0013 | 0.1500 | 2.19 | 0.07 |
| SCF | Benzo(a)pyrene | 0.483 | 0.322 | 0.0115 | 0.0037 | 0.0001 | 0.0002 | 0.0003 | 0.08 | 0.00 |
| SCF | Beryllium | 1.480 | 1.611 | 0.0100 | 0.0161 | 0.0005 | 0.0010 | 0.0015 | 0.12 | 0.01 |
| SCF | Bis(2-ethylhexyl) phthalate | 0.439 | 0.176 | 0.0001 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 1.5 | 0.00 |
| SCF | Cadmium | 6.132 | 7.413 | 0.6450 | 4.7814 | 0.1472 | 0.0046 | 0.1518 | 0.001 | 151.82 |
| SCF | Carbon tetrachloride | 0.003 | 0.000 | 0.9324 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 3 | 0.00 |
| SCF | Chloroform | 0.886 | 1.987 | 2.7040 | 5.3734 | 0.1655 | 0.0012 | 0.1667 | 2.8 | 0.06 |
| SCF | Chromium | 56.892 | 61.157 | 0.0410 | 2.5074 | 0.0772 | 0.0377 | 0.1149 | 0.61 | 0.19 |
| SCF | Copper | 20.555 | 27.899 | 0.4000 | 11.1596 | 0.3437 | 0.0172 | 0.3609 | 3.1 | 0.12 |
| SCF | Di-n-butlyphthalate | 0.470 | 0.118 | 0.1656 | 0.0196 | 0.0006 | 0.0001 | 0.0007 | 46 | 0.00 |

## Table G.10 (continued)

| Location | Analyte | Soil concentration (mg/kg) Mean | Soil concentration (mg/kg) PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) Food | Contaminant exposure (mg/kg/d) Soil | Contaminant exposure (mg/kg/d) Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| SCF | Dieldrin | 0.004 | 0.001 | 0.0317 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.00 |
| SCF | Endosulfan I | 0.003 | NA | NA | NA | NA | 0.0000 | 0.0000 | 0.03 | 0.00 |
| SCF | Endrin | 0.005 | 0.001 | 0.0555 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.008 | 0.00 |
| SCF | Heptachlor | 0.003 | NA | 0.1267 | 0.0004 | 0.0000 | 0.0000 | 0.0000 | 0.03 | 0.00 |
| SCF | Lead | 41.506 | 52.212 | 0.0450 | 2.3495 | 0.0724 | 0.0322 | 0.1045 | 1.5 | 0.07 |
| SCF | Manganese | 1392.092 | 1849.264 | 0.2500 | 462.3159 | 14.2377 | 1.1390 | 15.3767 | 16 | 0.96 |
| SCF | Mercury | 0.682 | 0.854 | 0.1430 | 0.1222 | 0.0038 | 0.0005 | 0.0043 | 0.006 | 0.71 |
| SCF | Methoxychlor | 0.027 | 0.014 | NA | NA | NA | 0.0000 | 0.0000 | 0.7 | 0.00 |
| SCF | Methylene chloride | 136.175 | 281.149 | 6.8640 | 1929.8077 | 59.4312 | 0.1732 | 59.6044 | 1.09 | 54.68 |
| SCF | Nickel | 18.418 | 20.372 | 0.0600 | 1.2223 | 0.0376 | 0.0125 | 0.0502 | 7.5 | 0.01 |
| SCF | PCB-1254 | 0.057 | 0.038 | 0.0127 | 0.0005 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.01 |
| SCF | PCB-1260 | 0.066 | 0.069 | 0.0029 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.004 | 0.01 |
| SCF | Pentachlorophenol | 0.266 | 0.005 | NA | NA | NA | 0.0000 | 0.0000 | 0.04 | 0.00 |
| SCF | Selenium | 2.796 | 2.965 | 0.0330 | 0.0978 | 0.0030 | 0.0018 | 0.0048 | 0.006 | 0.81 |
| SCF | Tetrachloroethene | 0.546 | 1.142 | 0.4196 | 0.4792 | 0.0148 | 0.0007 | 0.0155 | 0.1 | 0.15 |
| SCF | Toluene | 0.917 | 2.045 | 1.0651 | 2.1784 | 0.0671 | 0.0013 | 0.0683 | 2.2 | 0.03 |

## Table G.10 (continued)

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| SCF | Trichloroethene | 0.782 | 1.493 | 1.5878 | 2.3705 | 0.0730 | 0.0009 | 0.0739 | 0.06 | 1.23 |
| SCF | Uranium | 3.128 | 3.313 | 0.0063 | 0.0209 | 0.0006 | 0.0020 | 0.0027 | 0.25 | 0.01 |
| SCF | Zinc | 114.172 | 146.031 | 0.3701 | 54.0460 | 1.6644 | 0.0899 | 1.7544 | 30 | 0.06 |
| SCF | Alpha-chlordane | 0.003 | 0.001 | 0.0256 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| SCF | Delta-BHC | 0.003 | 0.000 | 0.4340 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.3 | 0.00 |
| SCF | Gamma-chlordane | 0.003 | 0.001 | 0.0256 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.4 | 0.00 |
| K-1420 OU | 1,2-Dichlorethane | 0.005 | 0.007 | 5.2602 | 0.0388 | 0.0012 | 0.0000 | 0.0012 | 4 | 0.00 |
| K-1420 OU | Acetone | 0.019 | 0.025 | 53.2970 | 1.3250 | 0.0408 | 0.0000 | 0.0408 | 1.9 | 0.02 |
| K-1420 OU | Aldrin | 0.011 | NA | 0.0250 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.04 | 0.00 |
| K-1420 OU | Aluminum | 19950.000 | 49308.945 | 0.0040 | 197.2358 | 6.0742 | 30.3708 | 36.4450 | 0.16 | 227.78 |
| K-1420 OU | Barium | 31.850 | 83.938 | 0.1500 | 12.5908 | 0.3878 | 0.0517 | 0.4395 | 1 | 0.44 |
| K-1420 OU | Benzo(a)pyrene | 0.378 | 0.386 | 0.0115 | 0.0045 | 0.0001 | 0.0002 | 0.0004 | 0.08 | 0.00 |

**Table G.10 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1420 OU | Beryllium | 0.375 | 1.290 | 0.0100 | 0.0129 | 0.0004 | 0.0008 | 0.0012 | 0.12 | 0.01 |
| K-1420 OU | Bis(2-ethylhexyl) phthalate | 0.215 | 0.289 | 0.0001 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 1.5 | 0.00 |
| K-1420 OU | Boron | 2.700 | NA | NA | NA | NA | 0.0017 | 0.0017 | 5.2 | 0.00 |
| K-1420 OU | Chromium | 15.200 | 25.472 | 0.0410 | 1.0443 | 0.0322 | 0.0157 | 0.0479 | 0.61 | 0.08 |
| K-1420 OU | Copper | 26.200 | 47.035 | 0.4000 | 18.8142 | 0.5794 | 0.0290 | 0.6084 | 3.1 | 0.20 |
| K-1420 OU | Fluoride | 40.015 | 0.030 | 0.0600 | 0.0018 | 0.0001 | 0.0000 | 0.0001 | 8.29 | 0.00 |
| K-1420 OU | Lead | 66.250 | 90.518 | 0.0450 | 4.0733 | 0.1254 | 0.0558 | 0.1812 | 1.5 | 0.12 |
| K-1420 OU | Lithium | 52.200 | 228.354 | NA | NA | NA | 0.1406 | 0.1406 | 1.8 | 0.08 |
| K-1420 OU | Manganese | 470.000 | 1960.045 | 0.2500 | 490.0113 | 15.0906 | 1.2072 | 16.2979 | 16 | 1.02 |
| K-1420 OU | Mercury | 0.203 | 0.430 | 0.1430 | 0.0615 | 0.0019 | 0.0003 | 0.0022 | 0.006 | 0.36 |
| K-1420 OU | Methylene chloride | 0.007 | 0.009 | 6.8640 | 0.0642 | 0.0020 | 0.0000 | 0.0020 | 1.09 | 0.00 |

**Table G.10 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Contaminant exposure (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1420 OU | Nitrate | 20.008 | 0.027 | NA | NA | NA | 0.0000 | 0.0000 | 127 | 0.00 |
| K-1420 OU | PCB-1254 | 0.663 | 1.693 | 0.0127 | 0.0215 | 0.0007 | 0.0010 | 0.0017 | 0.004 | 0.43 |
| K-1420 OU | Pentachlorophenol | 2.106 | NA | NA | NA | NA | 0.0013 | 0.0013 | 0.04 | 0.03 |
| K-1420 OU | Strontium | 38.250 | 255.759 | NA | NA | NA | 0.1575 | 0.1575 | 49 | 0.00 |
| K-1420 OU | Tetrachloroethene | 0.006 | NA | 0.4106 | 0.0025 | 0.0001 | 0.0000 | 0.0001 | 0.1 | 0.00 |
| K-1420 OU | Thallium | 0.720 | NA | NA | NA | NA | 0.0004 | 0.0004 | 0.001 | 0.44 |
| K-1420 OU | Trichloroethene | 0.041 | NA | 1.5878 | 0.0651 | 0.0020 | 0.0000 | 0.0020 | 0.06 | 0.03 |
| K-1420 OU | Uranium | 139.109 | 282.563 | 0.0063 | 1.7801 | 0.0548 | 0.1740 | 0.2289 | 0.25 | 0.92 |
| K-1420 OU | Vanadium | 48.900 | 141.081 | 0.0060 | 0.8465 | 0.0261 | 0.0869 | 0.1130 | 0.04 | 2.82 |
| K-1420 OU | Zinc | 84.350 | 154.117 | 0.3701 | 57.0387 | 1.7566 | 0.0949 | 1.8515 | 30 | 0.06 |
| K-1420 OU | Beta-BHC | 0.014 | NA | 0.4340 | 0.0059 | 0.0002 | 0.0000 | 0.0002 | 0.1 | 0.00 |

## Table G.10 (continued)

| | | Soil concentration (mg/kg) | | | | Contaminant exposure (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE UCB | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| K-1414 | Acetone | 0.031 | NA | 53.2970 | 1.6522 | 0.0509 | 0.0000 | 0.0509 | 1.9 | 0.03 |
| K-1414 | Benzo(a)pyrene | 0.287 | NA | 0.0115 | 0.0033 | 0.0001 | 0.0002 | 0.0003 | 0.08 | 0.00 |
| K-1414 | Bis(2-ethylhexyl) phthalate | 0.224 | NA | 0.0001 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 1.5 | 0.00 |
| K-1414 | Di-n-butlyphthalate | 0.740 | 2.382 | 0.1656 | 0.3943 | 0.0121 | 0.0015 | 0.0136 | 46 | 0.00 |
| K-1414 | Methylene chloride | 0.038 | 0.158 | 6.8640 | 1.0842 | 0.0334 | 0.0001 | 0.0335 | 1.09 | 0.03 |
| K-1414 | Tetrachloroethene | 0.004 | NA | 0.4196 | 0.0017 | 0.0001 | 0.0000 | 0.0001 | 0.1 | 0.00 |

NA= Not Available

PLE UCB not available - contaminant detected in only 1 sample.
Soil to plant uptake factor not available, therefore, estimated vegetation concentrations and exposure from food ingestion could not be calculated.

* Soil to plant uptake factors for antimony, arsenic, cadmium, chromium, mercury, selenium, zinc, and uranium were calculated using data collected from
Lower East Fork Poplar Creek. Other soil to plant uptake factors from Baes et al. 1984.

**Table G.10 (continued)**

## Total contaminant exposure for the white-tailed deer in WAG 5

| Location | Analyte | 95% UCL Water mg/L | 95% UCL Soil mg/kg | Soil-Plant Uptake Factor * | Plant Concentration mg/kg | Exposure mg/kg/d Water | Exposure mg/kg/d Soil | Exposure mg/kg/d Food | Exposure mg/kg/d total exposure | NOAEL Toxicity Benchmark mg/kg/d | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WAG 5 | Lead | 0 | 94 | 0.045 | 4.2300 | 0.0000 | 0.0579 | 0.1303 | 0.1882 | 1.5 | 0.13 |
| WAG 5 | Manganese | 4.09 | 1100 | 0.25 | 275.0000 | 0.2678 | 0.6775 | 8.4690 | 9.4144 | 16 | 0.59 |
| WAG 5 | Mercury | 0 | 1.3 | 0.143 | 0.1859 | 0.0000 | 0.0008 | 0.0057 | 0.0065 | 0.006 | 1.09 |
| WAG 5 | Nickel | 0.57 | 34 | 0.06 | 2.0400 | 0.0373 | 0.0209 | 0.0628 | 0.1211 | 7.5 | 0.02 |
| WAG 5 | Selenium | 0.24 | 0 | 0.033 | 0.0000 | 0.0157 | 0.0000 | 0.0000 | 0.0157 | 0.006 | 2.62 |
| WAG 5 | Vanadium | 0.09 | 34 | 0.006 | 0.2040 | 0.0059 | 0.0209 | 0.0063 | 0.0331 | 0.04 | 0.83 |
| WAG 5 | Zinc | 0.03 | 1000 | 0.3701 | 370.1000 | 0.0020 | 0.6159 | 11.3978 | 12.0157 | 30 | 0.40 |
| WAG 5 | Aroclor 1254 | 0 | 0.24 | 0.0127 | 0.0030 | 0.0000 | 0.0001 | 0.0001 | 0.0002 | 0.004 | 0.06 |
| WAG 5 | Aroclor 1260 | 0 | 0.18 | 0.0029 | 0.0005 | 0.0000 | 0.0001 | 0.0000 | 0.0001 | 0.004 | 0.03 |
| WAG 5 | Bis(2-Ethylhexyl) phthalate | 0 | 1.3 | 0.0001 | 0.0001 | 0.0000 | 0.0008 | 0.0000 | 0.0008 | 1.5 | 0.00 |
| WAG 5 | Di-n-butyl Phthalate | 0 | 1.5 | 0.1656 | 0.2484 | 0.0000 | 0.0009 | 0.0076 | 0.0086 | 46 | 0.00 |
| WAG 5 | Trichloroethene | 0.13 | 0 | 0.4196 | 0.0000 | 0.0085 | 0.0000 | 0.0000 | 0.0085 | 0.1 | 0.09 |

* Soil to plant uptake factors for antimony, arsenic, cadmium, chromium, mercury, selenium, zinc, and uranium were calculated using data collected from Lower East Fork Poplar Creek. Other soil to plant uptake factors from Baes et al. 1984.

Table G.11. Total contaminant exposure and NOAEL HQs for wild turkey on the ORR

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | 4,4-DDE | 0.108 | NA | 0.1047 | 0.0113 | 0.0003 | 0.0003 | 0.0006 | 0.0024 | 0.27 |
| BCVOU1 | 4,4-DDT | 0.108 | NA | 0.0080 | 0.0009 | 0.0000 | 0.0003 | 0.0003 | 0.0024 | 0.14 |
| BCVOU1 | Acetone | 0.036 | 0.043 | 53.2970 | 2.3048 | 0.0691 | 0.0001 | 0.0693 | NA | NA |
| BCVOU1 | Antimony | 1.031 | 1.737 | 0.0400 | 0.0695 | 0.0021 | 0.0049 | 0.0069 | NA | NA |
| BCVOU1 | Arsenic | 9.269 | 13.352 | 0.0040 | 0.0534 | 0.0016 | 0.0373 | 0.0389 | 2.87 | 0.01 |
| BCVOU1 | Barium | 264.315 | 403.009 | 0.1500 | 60.4513 | 1.8135 | 1.1256 | 2.9392 | 5.8 | 0.51 |
| BCVOU1 | Benzo(a)pyrene | 10.811 | 19.901 | 0.0115 | 0.2297 | 0.0069 | 0.0556 | 0.0625 | NA | NA |
| BCVOU1 | Beryllium | 1.051 | 1.428 | 0.0100 | 0.0143 | 0.0004 | 0.0040 | 0.0044 | NA | NA |
| BCVOU1 | Bis(2-ethylhexyl) phthalate | 3.333 | 0.587 | 0.0001 | 0.0001 | 0.0000 | 0.0016 | 0.0016 | 0.33 | 0.00 |
| BCVOU1 | Cadmium | 5.380 | 10.736 | 0.6450 | 6.9250 | 0.2077 | 0.0300 | 0.2377 | 0.9 | 0.26 |

**Table G.11 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | Chloroform | 0.012 | NA | 2.7040 | 0.0315 | 0.0009 | 0.0000 | 0.0010 | NA | NA |
| BCVOU1 | Chromium | 48.977 | 68.364 | 0.0410 | 2.8029 | 0.0841 | 0.1909 | 0.2750 | NA | NA |
| BCVOU1 | Copper | 972.062 | 1779.997 | 0.4000 | 711.9989 | 21.3600 | 4.9717 | 26.3317 | 21 | 1.25 |
| BCVOU1 | Di-n-butylphthalate | 2.999 | 0.316 | 0.1656 | 0.0524 | 0.0016 | 0.0009 | 0.0025 | 0.03 | 0.08 |
| BCVOU1 | Lead | 287.462 | 543.246 | 0.0450 | 24.4461 | 0.7334 | 1.5173 | 2.2507 | 0.34 | 6.62 |
| BCVOU1 | Mercury | 18.982 | 31.842 | 0.1430 | 4.5534 | 0.1366 | 0.0889 | 0.2255 | 0.004 | 56.39 |
| BCVOU1 | Methylene chloride | 0.017 | 0.023 | 6.8640 | 0.1601 | 0.0048 | 0.0001 | 0.0049 | NA | NA |
| BCVOU1 | Molybdenum | 8.855 | 18.202 | NA | NA | NA | 0.0508 | 0.0508 | 2.2 | 0.02 |
| BCVOU1 | Nickel | 85.108 | 137.529 | 0.0600 | 8.2517 | 0.2476 | 0.3841 | 0.6317 | 40 | 0.02 |
| BCVOU1 | PCB-1254 | 1.790 | 2.665 | 0.0127 | 0.0338 | 0.0010 | 0.0074 | 0.0085 | 0.1 | 0.08 |
| BCVOU1 | PCB-1260 | 3.651 | 6.741 | 0.0029 | 0.0195 | 0.0006 | 0.0188 | 0.0194 | 0.1 | 0.19 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | Selenium | 1.750 | 2.268 | 0.0330 | 0.0748 | 0.0022 | 0.0063 | 0.0086 | 0.3 | 0.03 |
| BCVOU1 | Tetrachloroethene | 0.012 | NA | 0.4196 | 0.0049 | 0.0001 | 0.0000 | 0.0002 | NA | NA |
| BCVOU1 | Tin | 20.523 | 34.428 | NA | NA | NA | 0.0962 | 0.0962 | 2 | 0.05 |
| BCVOU1 | Toluene | 0.314 | 0.399 | 1.0651 | 0.4252 | 0.0128 | 0.0011 | 0.0139 | NA | NA |
| BCVOU1 | Zinc | 668.908 | 1133.306 | 0.3701 | 419.4366 | 12.5831 | 3.1654 | 15.7485 | 10.1 | 1.56 |
| LEFPC | 4,4-DDD | 0.017 | 0.001 | 0.0151 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.00 |
| LEFPC | 4,4-DDE | 0.015 | 0.002 | 0.1047 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| LEFPC | 4,4-DDT | 0.017 | 0.001 | 0.0080 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.00 |
| LEFPC | Acetone | 0.254 | 0.577 | 53.2970 | 30.7414 | 0.9222 | 0.0016 | 0.9239 | NA | NA |
| LEFPC | Aldrin | 0.008 | 0.000 | 0.0250 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| LEFPC | Antimony | 1.284 | 0.787 | 0.0400 | 0.0315 | 0.0009 | 0.0022 | 0.0031 | NA | NA |
| LEFPC | Barium | 121.357 | 130.047 | 0.1500 | 19.5071 | 0.5852 | 0.3632 | 0.9484 | 5.8 | 0.16 |
| LEFPC | Benzo(a)pyrene | 0.492 | 0.484 | 0.0115 | 0.0056 | 0.0002 | 0.0014 | 0.0015 | NA | NA |

**Table G.11 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | Bis(2-ethylhexyl) phthalate | 0.334 | 0.201 | 0.0001 | 0.0000 | 0.0000 | 0.0006 | 0.0006 | 0.33 | 0.00 |
| LEFPC | Cadmium | 4.089 | 4.645 | 0.6450 | 2.9957 | 0.0899 | 0.0130 | 0.1028 | 0.9 | 0.11 |
| LEFPC | Chromium | 64.608 | 65.531 | 0.0410 | 2.6868 | 0.0806 | 0.1830 | 0.2636 | NA | NA |
| LEFPC | Copper | 78.033 | 89.671 | 0.4000 | 35.8685 | 1.0761 | 0.2505 | 1.3265 | 21 | 0.06 |
| LEFPC | Cyanide | 3.024 | 5.824 | NA | NA | NA | 0.0163 | 0.0163 | NA | NA |
| LEFPC | Di-n-butlyphthalate | 0.421 | 0.184 | 0.1656 | 0.0305 | 0.0009 | 0.0005 | 0.0014 | 0.03 | 0.05 |
| LEFPC | Dieldrin | 0.017 | 0.002 | 0.0317 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.034 | 0.00 |
| LEFPC | Diethylphthalate | 0.461 | 0.173 | 1.3899 | 0.2409 | 0.0072 | 0.0005 | 0.0077 | NA | NA |
| LEFPC | Endosulfan I | 0.008 | 0.001 | NA | NA | NA | 0.0000 | 0.0000 | 4 | 0.00 |
| LEFPC | Endosulfan II | 0.017 | 0.001 | NA | NA | NA | 0.0000 | 0.0000 | 4 | 0.00 |
| LEFPC | Endrin | 0.017 | 0.001 | 0.0555 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.18 | 0.00 |
| LEFPC | Heptachlor | 0.008 | 0.000 | 0.1267 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| LEFPC | Lead | 53.799 | 61.485 | 0.0450 | 2.7668 | 0.0830 | 0.1717 | 0.2547 | 0.34 | 0.75 |
| LEFPC | Lindane | 0.008 | 0.001 | 0.2741 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 1.1 | 0.00 |
| LEFPC | Mercury | 38.488 | 41.609 | 0.1430 | 5.9501 | 0.1785 | 0.1162 | 0.2947 | 0.004 | 73.68 |
| LEFPC | Methoxychlor | 0.083 | 0.006 | NA | NA | 0.0000 | 0.0000 | 0.0000 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | Methylene chloride | 0.037 | 0.053 | 6.8640 | 0.3634 | 0.0109 | 0.0001 | 0.0111 | NA | NA |
| LEFPC | Nickel | 34.367 | 37.906 | 0.0600 | 2.2744 | 0.0682 | 0.1059 | 0.1741 | 40 | 0.00 |
| LEFPC | PCB-1016 | 0.090 | 0.050 | NA | NA | NA | 0.0001 | 0.0001 | NA | NA |
| LEFPC | PCB-1242 | 0.090 | 0.050 | 0.0029 | 0.0001 | 0.0000 | 0.0001 | 0.0001 | 0.13 | 0.00 |
| LEFPC | PCB-1248 | 0.090 | 0.050 | 0.0029 | 0.0001 | 0.0000 | 0.0001 | 0.0001 | NA | NA |
| LEFPC | PCB-1254 | 0.258 | 0.224 | 0.0127 | 0.0028 | 0.0001 | 0.0006 | 0.0007 | 0.1 | 0.01 |
| LEFPC | PCB-1260 | 0.431 | 0.465 | 0.0029 | 0.0013 | 0.0000 | 0.0013 | 0.0013 | 0.1 | 0.01 |
| LEFPC | Pentachlorophenol | 1.692 | 0.377 | NA | NA | NA | 0.0011 | 0.0011 | NA | NA |
| LEFPC | Selenium | 13.566 | 8.704 | 0.0330 | 0.2872 | 0.0086 | 0.0243 | 0.0329 | 0.3 | 0.11 |
| LEFPC | Thallium | 0.809 | NA | NA | NA | NA | 0.0023 | 0.0023 | NA | NA |
| LEFPC | Uranium | 9.708 | 11.895 | 0.0063 | 0.0749 | 0.0022 | 0.0332 | 0.0355 | 10 | 0.00 |
| LEFPC | Zinc | 179.913 | 166.199 | 0.3701 | 61.5103 | 1.8453 | 0.4642 | 2.3095 | 10.1 | 0.23 |
| LEFPC | Alpha-chlordane | 0.073 | 0.003 | 0.0257 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |
| LEFPC | Delta-BHC | 0.008 | 0.000 | 0.4340 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.17 | 0.00 |
| LEFPC | Gamma-chlordane | 0.073 | 0.001 | 0.0257 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1407 OU | 1,1,1-trichlorethane | 0.015 | NA | 1.3899 | 0.0215 | 0.0006 | 0.0000 | 0.0007 | NA | NA |
| K-1407 OU | 1,2-Dichlorethene | 0.017 | 0.028 | 3.0889 | 0.0856 | 0.0026 | 0.0001 | 0.0026 | NA | NA |
| K-1407 OU | Acetone | 0.028 | 0.019 | 53.2970 | 1.0007 | 0.0300 | 0.0001 | 0.0301 | NA | NA |
| K-1407 OU | Aluminum | 26562.96 | 28723.527 | 0.0040 | 114.8941 | 3.4468 | 80.2278 | 83.6746 | 33.2 | 2.52 |
| K-1407 OU | Antimony | 7.151 | NA | 0.0400 | 0.2860 | 0.0086 | 0.0200 | 0.0286 | NA | NA |
| K-1407 OU | Arsenic | 12.433 | 13.068 | 0.0040 | 0.0523 | 0.0016 | 0.0365 | 0.0381 | 2.87 | 0.01 |
| K-1407 OU | Barium | 110.494 | 125.275 | 0.1500 | 18.7913 | 0.5637 | 0.3499 | 0.9136 | 5.8 | 0.16 |
| K-1407 OU | Beryllium | 1.016 | 1.127 | 0.0100 | 0.0113 | 0.0003 | 0.0031 | 0.0035 | NA | NA |
| K-1407 OU | Boron | 6.419 | 8.400 | NA | NA | NA | 0.0235 | 0.0235 | 16.1 | 0.00 |
| K-1407 OU | Cadmium | 1.880 | 2.149 | 0.6450 | 1.3863 | 0.0416 | 0.0060 | 0.0476 | 0.9 | 0.05 |
| K-1407 OU | Chloroform | 0.016 | 0.012 | 2.7040 | 0.0322 | 0.0010 | 0.0000 | 0.0010 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1407 OU | Chromium | 61.037 | 69.864 | 0.0410 | 2.8644 | 0.0859 | 0.1951 | 0.2811 | NA | NA |
| K-1407 OU | Copper | 40.854 | 48.640 | 0.4000 | 19.4559 | 0.5837 | 0.1359 | 0.7195 | 21 | 0.03 |
| K-1407 OU | Di-n-butylphthalate | 0.017 | 0.018 | 0.1656 | 0.0031 | 0.0001 | 0.0001 | 0.0001 | 0.03 | 0.00 |
| K-1407 OU | Lead | 30.675 | 32.996 | 0.0450 | 1.4848 | 0.0445 | 0.0922 | 0.1367 | 0.34 | 0.40 |
| K-1407 OU | Mercury | 4.725 | 6.396 | 0.1430 | 0.9147 | 0.0274 | 0.0179 | 0.0453 | 0.004 | 11.33 |
| K-1407 OU | Methylene chloride | 0.018 | 0.021 | 6.8640 | 0.1457 | 0.0044 | 0.0001 | 0.0044 | NA | NA |
| K-1407 OU | Nickel | 192.179 | 251.090 | 0.0600 | 15.0654 | 0.4520 | 0.7013 | 1.1533 | 40 | 0.03 |
| K-1407 OU | Selenium | 7.152 | NA | 0.0330 | 0.2360 | 0.0071 | 0.0200 | 0.0271 | 0.3 | 0.09 |
| K-1407 OU | Strontium | 18.142 | 20.670 | NA | NA | NA | 0.0577 | 0.0577 | NA | NA |
| K-1407 OU | Tetrachloroethene | 0.023 | 0.024 | 0.4196 | 0.0102 | 0.0003 | 0.0001 | 0.0004 | NA | NA |
| K-1407 OU | Toluene | 0.011 | 0.001 | 1.0651 | 0.0011 | 0.0000 | 0.0000 | 0.0000 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1407 OU | Trichloroethene | 0.025 | 0.028 | 1.5878 | 0.0446 | 0.0013 | 0.0001 | 0.0014 | NA | NA |
| K-1407 OU | Uranium | 143.694 | 255.850 | 0.0063 | 1.6119 | 0.0484 | 0.7146 | 0.7630 | 10 | 0.08 |
| K-1407 OU | Zinc | 59.778 | 64.471 | 0.3701 | 23.8607 | 0.7158 | 0.1801 | 0.8959 | 10.1 | 0.09 |
| WAG 1 | 1,1,1-trichlorethane | 0.008 | 0.003 | 1.3899 | 0.0045 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| WAG 1 | 1,1-Dichlorethene | 0.008 | 0.006 | NA | NA | NA | 0.0000 | 0.0000 | NA | NA |
| WAG 1 | 1,2-Dichlorethane | 0.008 | 0.006 | 5.2602 | 0.0316 | 0.0009 | 0.0000 | 0.0010 | 11.2 | 0.00 |
| WAG 1 | 1,2-Dichlorethene | 0.008 | 0.002 | 3.0889 | 0.0070 | 0.0002 | 0.0000 | 0.0002 | NA | NA |
| WAG 1 | 4,4-DDD | 0.021 | NA | 0.0151 | 0.0003 | 0.0000 | 0.0001 | 0.0001 | 0.0024 | 0.03 |
| WAG 1 | 4,4-DDE | 0.022 | NA | 0.1047 | 0.0023 | 0.0001 | 0.0001 | 0.0001 | 0.0024 | 0.05 |
| WAG 1 | 4,4-DDT | 0.021 | 0.010 | 0.0080 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| WAG 1 | Acetone | 0.028 | 0.029 | 53.2970 | 1.5641 | 0.0469 | 0.0001 | 0.0470 | NA | NA |
| WAG 1 | Antimony | 6.127 | 6.062 | 0.0400 | 0.2425 | 0.0073 | 0.0169 | 0.0242 | NA | NA |
| WAG 1 | Arsenic | 9.012 | 9.769 | 0.0040 | 0.0391 | 0.0012 | 0.0273 | 0.0285 | 2.87 | 0.01 |
| WAG 1 | Benzene | 0.008 | 0.003 | 2.3670 | 0.0074 | 0.0002 | 0.0000 | 0.0002 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | Benzo(a)pyrene | 0.678 | 0.726 | 0.0115 | 0.0084 | 0.0003 | 0.0020 | 0.0023 | NA | NA |
| WAG 1 | Beryllium | 0.949 | 1.013 | 0.0100 | 0.0101 | 0.0003 | 0.0028 | 0.0031 | NA | NA |
| WAG 1 | Bis(2-ethylhexyl) phthalate | 0.458 | 0.441 | 0.0001 | 0.0000 | 0.0000 | 0.0012 | 0.0012 | 0.33 | 0.00 |
| WAG 1 | Boron | 1204.965 | 1761.234 | NA | NA | NA | 4.9193 | 4.9193 | 16.1 | 0.31 |
| WAG 1 | Cadmium | 1.770 | 1.962 | 0.6450 | 1.2654 | 0.0380 | 0.0055 | 0.0434 | 0.9 | 0.05 |
| WAG 1 | Carbon tetrachloride | 0.008 | 0.006 | 0.9324 | 0.0056 | 0.0002 | 0.0000 | 0.0002 | NA | NA |
| WAG 1 | Chloroform | 0.010 | 0.009 | 2.7040 | 0.0244 | 0.0007 | 0.0000 | 0.0008 | NA | NA |
| WAG 1 | Chromium | 28.951 | 32.958 | 0.0410 | 1.3513 | 0.0405 | 0.0921 | 0.1326 | NA | NA |
| WAG 1 | Copper | 19.625 | 22.256 | 0.4000 | 8.9025 | 0.2671 | 0.0622 | 0.3292 | 21 | 0.02 |
| WAG 1 | Cyanide | 4.681 | NA | NA | NA | NA | 0.0131 | 0.0131 | NA | NA |
| WAG 1 | Di-n-butlyphthalate | 0.720 | 0.700 | 0.1656 | 0.1160 | 0.0035 | 0.0020 | 0.0054 | 0.03 | 0.18 |
| WAG 1 | Diethylphthalate | 0.579 | 0.048 | 1.3899 | 0.0668 | 0.0020 | 0.0001 | 0.0021 | NA | NA |
| WAG 1 | Endrin | 0.021 | NA | 0.0545 | 0.0011 | 0.0000 | 0.0001 | 0.0001 | 0.18 | 0.00 |
| WAG 1 | Heptachlor | 0.011 | NA | 0.1267 | 0.0013 | 0.0000 | 0.0000 | 0.0001 | NA | NA |
| WAG 1 | Lead | 40.874 | 46.324 | 0.0450 | 2.0846 | 0.0625 | 0.1294 | 0.1919 | 0.34 | 0.56 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | Mercury | 1.306 | 1.850 | 0.1430 | 0.2645 | 0.0079 | 0.0052 | 0.0131 | 0.004 | 3.28 |
| WAG 1 | Methylene chloride | 0.031 | 0.037 | 6.8640 | 0.2516 | 0.0075 | 0.0001 | 0.0076 | NA | NA |
| WAG 1 | PCB-1254 | 0.350 | 0.440 | 0.0127 | 0.0056 | 0.0002 | 0.0012 | 0.0014 | 0.1 | 0.01 |
| WAG 1 | PCB-1260 | 0.247 | 0.227 | 0.0029 | 0.0007 | 0.0000 | 0.0006 | 0.0007 | 0.1 | 0.01 |
| WAG 1 | Pentachlorophenol | 2.957 | 0.280 | NA | NA | NA | 0.0008 | 0.0008 | NA | NA |
| WAG 1 | Selenium | 14.565 | 16.841 | 0.0330 | 0.5558 | 0.0167 | 0.0470 | 0.0637 | 0.3 | 0.21 |
| WAG 1 | Tetrachloroethene | 0.008 | 0.004 | 0.4196 | 0.0018 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| WAG 1 | Thallium | 14.168 | 15.851 | NA | NA | NA | 0.0443 | 0.0443 | NA | NA |
| WAG 1 | Tin | 50.730 | 54.202 | NA | NA | NA | 0.1514 | 0.1514 | 2 | 0.08 |
| WAG 1 | Toluene | 0.007 | 0.004 | 1.0651 | 0.0038 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| WAG 1 | Trichloroethene | 0.007 | 0.002 | 1.5878 | 0.0036 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| WAG 1 | Uranium | 7.957 | 14.470 | 0.0063 | 0.0912 | 0.0027 | 0.0404 | 0.0432 | 10 | 0.00 |
| WAG 1 | Vinyl chloride | 0.015 | 0.012 | 6.0089 | 0.0723 | 0.0022 | 0.0000 | 0.0022 | NA | NA |
| WAG 1 | Zinc | 91.993 | 105.628 | 0.3701 | 39.0929 | 1.1728 | 0.2950 | 1.4678 | 10.1 | 0.15 |
| WAG 1 | Alpha-BHC | 0.012 | NA | 0.4340 | 0.0051 | 0.0002 | 0.0000 | 0.0002 | 0.17 | 0.00 |
| WAG 1 | Alpha-chlordane | 0.105 | NA | 0.0256 | 0.0027 | 0.0001 | 0.0003 | 0.0004 | 0.48 | 0.00 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | Gamma-chlordane | 0.104 | NA | 0.0256 | 0.0027 | 0.0001 | 0.0003 | 0.0004 | 0.48 | 0.00 |
| WAG 6 | 1,2-Dichlorethene | 0.007 | NA | 3.0889 | 0.0209 | 0.0006 | 0.0000 | 0.0006 | NA | NA |
| WAG 6 | 1,4-Dioxane | 6.675 | 7.559 | NA | NA | NA | 0.0211 | 0.0211 | NA | NA |
| WAG 6 | Acetone | 0.014 | 0.015 | 53.2970 | 0.7822 | 0.0235 | 0.0000 | 0.0235 | NA | NA |
| WAG 6 | Barium | 132.813 | 143.471 | 0.1500 | 21.5206 | 0.6456 | 0.4007 | 1.0463 | 5.8 | 0.18 |
| WAG 6 | Beryllium | 1.383 | 1.486 | 0.0100 | 0.0149 | 0.0004 | 0.0042 | 0.0046 | NA | NA |
| WAG 6 | Bis(2-ethylhexyl) phthalate | 0.398 | 0.462 | 0.0001 | 0.0001 | 0.0000 | 0.0013 | 0.0013 | 0.33 | 0.00 |
| WAG 6 | Cadmium | 2.501 | 2.846 | 0.6450 | 1.8354 | 0.0551 | 0.0079 | 0.0630 | 0.9 | 0.07 |
| WAG 6 | Chloroform | 0.011 | 0.013 | 2.7040 | 0.0346 | 0.0010 | 0.0000 | 0.0011 | NA | NA |
| WAG 6 | Cyanide | 23.817 | NA | NA | NA | NA | 0.0665 | 0.0665 | NA | NA |
| WAG 6 | Methylene chloride | 0.028 | 0.038 | 6.8640 | 0.2595 | 0.0078 | 0.0001 | 0.0079 | NA | NA |
| WAG 6 | Nickel | 38.284 | 41.626 | 0.0600 | 2.4975 | 0.0749 | 0.1163 | 0.1912 | 40 | 0.00 |
| WAG 6 | Tetrachloroethene | 0.006 | 0.003 | 0.4196 | 0.0014 | 0.0000 | 0.0000 | 0.0001 | NA | NA |
| WAG 6 | Tin | 55.025 | 89.243 | NA | NA | NA | 0.2493 | 0.2493 | 2 | 0.12 |
| WAG 6 | Toluene | 0.004 | 0.002 | 1.0651 | 0.0026 | 0.0001 | 0.0000 | 0.0001 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 6 | Trichloroethene | 0.005 | 0.004 | 1.5878 | 0.0057 | 0.0002 | 0.0000 | 0.0002 | NA | NA |
| WAG 6 | Uranium | 0.818 | 1.007 | 0.0063 | 0.0063 | 0.0002 | 0.0028 | 0.0030 | 10 | 0.00 |
| UEFPC OU 2 | Aluminum | 29900.00 | 65257.008 | 0.0040 | 261.0280 | 7.8308 | 182.2696 | 190.1004 | 33.2 | 5.73 |
| UEFPC OU 2 | Barium | 149.850 | 567.505 | 0.1500 | 85.1257 | 2.5538 | 1.5851 | 4.1389 | 5.8 | 0.71 |
| UEFPC OU 2 | Beryllium | 1.250 | 2.197 | 0.0100 | 0.0220 | 0.0007 | 0.0061 | 0.0068 | NA | NA |
| UEFPC OU 2 | Chromium | 39.700 | 76.951 | 0.0410 | 3.1550 | 0.0946 | 0.2149 | 0.3096 | NA | NA |
| UEFPC OU 2 | Copper | 22.100 | 54.932 | 0.4000 | 21.9726 | 0.6592 | 0.1534 | 0.8126 | 21 | 0.04 |
| UEFPC OU 2 | Lead | 36.600 | 250.005 | 0.0450 | 11.2502 | 0.3375 | 0.6983 | 1.0358 | 0.34 | 3.05 |
| UEFPC OU 2 | Lithium | 22.700 | 31.539 | NA | NA | NA | 0.0881 | 0.0881 | NA | NA |
| UEFPC OU 2 | Manganese | 484.000 | 2592.793 | 0.2500 | 648.1983 | 19.4459 | 7.2419 | 26.6879 | 230 | 0.12 |
| UEFPC OU 2 | Nickel | 36.200 | 57.035 | 0.0600 | 3.4221 | 0.1027 | 0.1593 | 0.2620 | 40 | 0.01 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| UEFPC OU 2 | Nitrate | 0.585 | 1.122 | NA | NA | NA | 0.0031 | 0.0031 | NA | NA |
| UEFPC OU 2 | Strontium | 21.100 | 117.700 | NA | NA | NA | 0.3287 | 0.3287 | NA | NA |
| UEFPC OU 2 | Uranium | 1.565 | 6.206 | 0.0063 | 0.0391 | 0.0012 | 0.0173 | 0.0185 | 10 | 0.00 |
| UEFPC OU 2 | Zinc | 86.200 | 286.977 | 0.3701 | 106.2103 | 3.1863 | 0.8016 | 3.9879 | 10.1 | 0.39 |
| BC OU 2 | 1,1,1-trichlorethane | 0.008 | 0.008 | 1.3899 | 0.0113 | 0.0003 | 0.0000 | 0.0004 | NA | NA |
| BC OU 2 | 1,1-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.0000 | 0.0000 | NA | NA |
| BC OU 2 | 1,2-Dichlorethane | 0.008 | 0.008 | 5.2602 | 0.0426 | 0.0013 | 0.0000 | 0.0013 | 11.2 | 0.00 |
| BC OU 2 | 1,2-Dichlorethene | 0.008 | 0.008 | 3.0889 | 0.0250 | 0.0008 | 0.0000 | 0.0008 | NA | NA |
| BC OU 2 | 4,4-DDD | 0.005 | 0.006 | 0.0151 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| BC OU 2 | 4,4-DDE | 0.005 | 0.006 | 0.1047 | 0.0006 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| BC OU 2 | 4,4-DDT | 0.005 | 0.006 | 0.0080 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| BC OU 2 | Acetone | 0.051 | 0.105 | 53.2970 | 5.6010 | 0.1680 | 0.0003 | 0.1683 | NA | NA |
| BC OU 2 | Aldrin | 0.003 | 0.003 | 0.0250 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Aluminum | 26143.85 | 35920.340 | 0.0040 | 143.6814 | 4.3104 | 100.3292 | 104.6397 | 33.2 | 3.15 |
| BC OU 2 | Antimony | 0.309 | 0.357 | 0.0400 | 0.0143 | 0.0004 | 0.0010 | 0.0014 | NA | NA |
| BC OU 2 | Arsenic | 33.369 | 35.093 | 0.0040 | 0.1404 | 0.0042 | 0.0980 | 0.1022 | 2.87 | 0.04 |
| BC OU 2 | Barium | 101.400 | 153.978 | 0.1500 | 23.0967 | 0.6929 | 0.4301 | 1.1230 | 5.8 | 0.19 |
| BC OU 2 | Benzene | 0.008 | 0.008 | 2.3670 | 0.0192 | 0.0006 | 0.0000 | 0.0006 | NA | NA |
| BC OU 2 | Benzo(a)pyrene | 0.499 | 0.529 | 0.0115 | 0.0061 | 0.0002 | 0.0015 | 0.0017 | NA | NA |
| BC OU 2 | Beryllium | 1.025 | 1.315 | 0.0100 | 0.0132 | 0.0004 | 0.0037 | 0.0041 | NA | NA |
| BC OU 2 | Bis(2-ethylhexyl) phthalate | 0.499 | 0.529 | 0.0001 | 0.0001 | 0.0000 | 0.0015 | 0.0015 | 0.33 | 0.00 |
| BC OU 2 | Boron | 65.500 | 79.406 | NA | NA | NA | 0.2218 | 0.2218 | 16.1 | 0.01 |
| BC OU 2 | Cadmium | 1.247 | 0.857 | 0.6450 | 0.5529 | 0.0166 | 0.0024 | 0.0190 | 0.9 | 0.02 |
| BC OU 2 | Carbon tetrachloride | 0.008 | 0.008 | 0.9324 | 0.0076 | 0.0002 | 0.0000 | 0.0002 | NA | NA |
| BC OU 2 | Chloroform | 0.008 | 0.008 | 2.7040 | 0.0219 | 0.0007 | 0.0000 | 0.0007 | NA | NA |
| BC OU 2 | Chromium | 37.331 | 44.232 | 0.0410 | 1.8135 | 0.0544 | 0.1235 | 0.1780 | NA | NA |
| BC OU 2 | Copper | 39.223 | 57.365 | 0.4000 | 22.9461 | 0.6884 | 0.1602 | 0.8486 | 21 | 0.04 |
| BC OU 2 | Di-n-butlyphthalate | 0.499 | 0.529 | 0.1656 | 0.0876 | 0.0026 | 0.0015 | 0.0041 | 0.03 | 0.14 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Dieldrin | 0.005 | 0.006 | 0.0317 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.034 | 0.00 |
| BC OU 2 | Diethylphthalate | 0.499 | 0.529 | 1.3899 | 0.7353 | 0.0221 | 0.0015 | 0.0235 | NA | NA |
| BC OU 2 | Endosulfan I | 0.003 | 0.003 | NA | NA | NA | 0.0000 | 0.0000 | 4 | 0.00 |
| BC OU 2 | Endosulfan II | 0.005 | 0.006 | NA | NA | NA | 0.0000 | 0.0000 | 4 | 0.00 |
| BC OU 2 | Endrin | 0.005 | 0.006 | 0.0555 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.18 | 0.00 |
| BC OU 2 | Heptachlor | 0.003 | 0.003 | 0.1267 | 0.0004 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| BC OU 2 | Lead | 81.015 | 126.822 | 0.0450 | 5.7070 | 0.1712 | 0.3542 | 0.5254 | 0.34 | 1.55 |
| BC OU 2 | Lindane | 0.003 | 0.003 | 0.2741 | 0.0008 | 0.0000 | 0.0000 | 0.0000 | 1.1 | 0.00 |
| BC OU 2 | Lithium | 39.250 | 47.194 | NA | NA | NA | 0.1318 | 0.1318 | NA | NA |
| BC OU 2 | Manganese | 1021.523 | 1779.367 | 0.2500 | 444.8418 | 13.3453 | 4.9700 | 18.3152 | 230 | 0.08 |
| BC OU 2 | Mercury | 49.019 | 76.055 | 0.1430 | 10.8759 | 0.3263 | 0.2124 | 0.5387 | 0.004 | 134.68 |
| BC OU 2 | Methoxychlor | 0.026 | 0.028 | NA | NA | NA | 0.0001 | 0.0001 | NA | NA |
| BC OU 2 | Methylene chloride | 0.016 | 0.018 | 6.8640 | 0.1231 | 0.0037 | 0.0001 | 0.0037 | NA | NA |
| BC OU 2 | Nickel | 32.600 | 50.322 | 0.0600 | 3.0193 | 0.0906 | 0.1406 | 0.2311 | 40 | 0.01 |
| BC OU 2 | Niobium | 9.850 | NA | NA | NA | NA | 0.0275 | 0.0275 | NA | NA |
| BC OU 2 | PCB-1016 | 0.052 | 0.056 | NA | NA | NA | 0.0002 | 0.0002 | NA | NA |

**Table G.11 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | PCB-1242 | 0.052 | 0.056 | 0.0029 | 0.0002 | 0.0000 | 0.0002 | 0.0002 | 0.13 | 0.00 |
| BC OU 2 | PCB-1248 | 0.052 | 0.056 | 0.0029 | 0.0002 | 0.0000 | 0.0002 | 0.0002 | NA | NA |
| BC OU 2 | PCB-1254 | 0.052 | 0.056 | 0.0127 | 0.0007 | 0.0000 | 0.0002 | 0.0002 | 0.1 | 0.00 |
| BC OU 2 | PCB-1260 | 0.042 | 0.048 | 0.0029 | 0.0001 | 0.0000 | 0.0001 | 0.0001 | 0.1 | 0.00 |
| BC OU 2 | Pentachlorophenol | 1.211 | 1.296 | NA | NA | NA | 0.0036 | 0.0036 | NA | NA |
| BC OU 2 | Selenium | 1.094 | 1.788 | 0.0330 | 0.0590 | 0.0018 | 0.0050 | 0.0068 | 0.3 | 0.02 |
| BC OU 2 | Strontium | 109.925 | 133.870 | NA | NA | NA | 0.3739 | 0.3739 | NA | NA |
| BC OU 2 | Tetrachloroethene | 0.007 | 0.008 | 0.4196 | 0.0033 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| BC OU 2 | Toluene | 0.008 | 0.008 | 1.0651 | 0.0086 | 0.0003 | 0.0000 | 0.0003 | NA | NA |
| BC OU 2 | Toxaphene | 0.261 | 0.284 | NA | NA | NA | 0.0008 | 0.0008 | NA | NA |
| BC OU 2 | Trichloroethene | 0.008 | 0.008 | 1.5878 | 0.0129 | 0.0004 | 0.0000 | 0.0004 | NA | NA |
| BC OU 2 | Uranium | 2.041 | 2.517 | 0.0063 | 0.0159 | 0.0005 | 0.0070 | 0.0075 | 10 | 0.00 |
| BC OU 2 | Vanadium | 54.838 | 62.578 | 0.0060 | 0.3755 | 0.0113 | 0.1748 | 0.1860 | 6.7 | 0.03 |
| BC OU 2 | Vinyl chloride | 0.015 | 0.016 | 6.0089 | 0.0974 | 0.0029 | 0.0000 | 0.0030 | NA | NA |
| BC OU 2 | Zinc | 113.208 | 149.418 | 0.3701 | 55.2996 | 1.6590 | 0.4173 | 2.0763 | 10.1 | 0.21 |
| BC OU 2 | Zirconium | 59.250 | 74.483 | NA | NA | NA | 0.2080 | 0.2080 | NA | NA |
| BC OU 2 | Alpha-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | 0.17 | 0.00 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Alpha-chlordane | 0.003 | 0.003 | 0.0256 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |
| BC OU 2 | Beta-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| BC OU 2 | Delta-BHC | 0.003 | 0.003 | 0.4340 | 0.0012 | 0.0000 | 0.0000 | 0.0000 | 0.17 | 0.00 |
| BC OU 2 | Gamma-chlordane | 0.003 | 0.003 | 0.0256 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |
| SCF | 1,1,1-trichlorethane | 0.436 | 0.955 | 1.3899 | 1.3273 | 0.0398 | 0.0027 | 0.0425 | NA | NA |
| SCF | 1,1-Dichlorethene | 10.464 | 19.679 | NA | NA | NA | 0.0550 | 0.0550 | NA | NA |
| SCF | 1,2-Dichlorethane | 60.893 | 157.216 | 5.2602 | 826.9877 | 24.8096 | 0.4391 | 25.2488 | 11.2 | 2.25 |
| SCF | 4,4-DDD | 0.005 | 0.001 | 0.0151 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.00 |
| SCF | 4,4-DDE | 0.003 | 0.002 | 0.1047 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.00 |
| SCF | 4,4-DDT | 0.006 | 0.006 | 0.0080 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0024 | 0.01 |
| SCF | Acetone | 97.955 | 212.986 | 53.2970 | 11351.5129 | 340.5454 | 0.5949 | 341.1403 | NA | NA |
| SCF | Aldrin | 0.003 | 0.000 | 0.0250 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| SCF | Aluminum | 16294.05 | 20546.940 | 0.0040 | 82.1878 | 2.4656 | 57.3897 | 59.8554 | 33.2 | 1.80 |
| SCF | Antimony | 3.125 | 1.215 | 0.0400 | 0.0486 | 0.0015 | 0.0034 | 0.0049 | NA | NA |
| SCF | Arsenic | 12.771 | 14.534 | 0.0040 | 0.0581 | 0.0017 | 0.0406 | 0.0423 | 2.87 | 0.01 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | Barium | 111.605 | 139.739 | 0.1500 | 20.9608 | 0.6288 | 0.3903 | 1.0191 | 5.8 | 0.18 |
| SCF | Benzene | 0.916 | 2.040 | 2.3670 | 4.8287 | 0.1449 | 0.0057 | 0.1506 | NA | NA |
| SCF | Benzo(a)pyrene | 0.483 | 0.322 | 0.0115 | 0.0037 | 0.0001 | 0.0009 | 0.0010 | NA | NA |
| SCF | Beryllium | 1.480 | 1.611 | 0.0100 | 0.0161 | 0.0005 | 0.0045 | 0.0050 | NA | NA |
| SCF | Bis(2-ethylhexyl) phthalate | 0.439 | 0.176 | 0.0001 | 0.0000 | 0.0000 | 0.0005 | 0.0005 | 0.33 | 0.00 |
| SCF | Cadmium | 6.132 | 7.413 | 0.6450 | 4.7814 | 0.1434 | 0.0207 | 0.1641 | 0.9 | 0.18 |
| SCF | Carbon tetrachloride | 0.003 | 0.000 | 0.9324 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| SCF | Chloroform | 0.886 | 1.987 | 2.7040 | 5.3734 | 0.1612 | 0.0056 | 0.1668 | NA | NA |
| SCF | Chromium | 56.892 | 61.157 | 0.0410 | 2.5074 | 0.0752 | 0.1708 | 0.2460 | NA | NA |
| SCF | Copper | 20.555 | 27.899 | 0.4000 | 11.1596 | 0.3348 | 0.0779 | 0.4127 | 21 | 0.02 |
| SCF | Di-n-butlyphthalate | 0.470 | 0.118 | 0.1656 | 0.0196 | 0.0006 | 0.0003 | 0.0009 | 0.03 | 0.03 |
| SCF | Dieldrin | 0.004 | 0.001 | 0.0317 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.034 | 0.00 |
| SCF | Endosulfan I | 0.003 | NA | NA | NA | NA | 0.0000 | 0.0000 | 4 | 0.00 |
| SCF | Endrin | 0.005 | 0.001 | 0.0555 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.18 | 0.00 |
| SCF | Heptachlor | 0.003 | NA | 0.1267 | 0.0004 | 0.0000 | 0.0000 | 0.0000 | NA | NA |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | Lead | 41.506 | 52.212 | 0.0450 | 2.3495 | 0.0705 | 0.1458 | 0.2163 | 0.34 | 0.64 |
| SCF | Manganese | 1392.092 | 1849.264 | 0.2500 | 462.3159 | 13.8695 | 5.1652 | 19.0347 | 230 | 0.08 |
| SCF | Mercury | 0.682 | 0.854 | 0.1430 | 0.1222 | 0.0037 | 0.0024 | 0.0061 | 0.004 | 1.51 |
| SCF | Methoxychlor | 0.027 | 0.014 | NA | NA | NA | 0.0000 | 0.0000 | NA | NA |
| SCF | Methylene chloride | 136.175 | 281.149 | 6.8640 | 1929.8077 | 57.8942 | 0.7853 | 58.6795 | NA | NA |
| SCF | Nickel | 18.418 | 20.372 | 0.0600 | 1.2223 | 0.0367 | 0.0569 | 0.0936 | 40 | 0.00 |
| SCF | PCB-1254 | 0.057 | 0.038 | 0.0127 | 0.0005 | 0.0000 | 0.0001 | 0.0001 | 0.1 | 0.00 |
| SCF | PCB-1260 | 0.066 | 0.069 | 0.0029 | 0.0002 | 0.0000 | 0.0002 | 0.0002 | 0.1 | 0.00 |
| SCF | Pentachlorophenol | 0.266 | 0.005 | NA | NA | NA | 0.0000 | 0.0000 | NA | NA |
| SCF | Selenium | 2.796 | 2.965 | 0.0330 | 0.0978 | 0.0029 | 0.0083 | 0.0112 | 0.3 | 0.04 |
| SCF | Tetrachloroethene | 0.546 | 1.142 | 0.4196 | 0.4792 | 0.0144 | 0.0032 | 0.0176 | NA | NA |
| SCF | Toluene | 0.917 | 2.045 | 1.0651 | 2.1784 | 0.0654 | 0.0057 | 0.0711 | NA | NA |
| SCF | Trichloroethene | 0.782 | 1.493 | 1.5878 | 2.3705 | 0.0711 | 0.0042 | 0.0753 | NA | NA |
| SCF | Uranium | 3.128 | 3.313 | 0.0063 | 0.0209 | 0.0006 | 0.0093 | 0.0099 | 10 | 0.00 |
| SCF | Zinc | 114.172 | 146.031 | 0.3701 | 54.0460 | 1.6214 | 0.4079 | 2.0293 | 10.1 | 0.20 |
| SCF | Alpha-chlordane | 0.003 | 0.001 | 0.0256 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | Delta-BHC | 0.003 | 0.000 | 0.4340 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.17 | 0.00 |
| SCF | Gamma-chlordane | 0.003 | 0.001 | 0.0256 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.48 | 0.00 |
| K-1420 OU | 1,2-Dichlorethane | 0.005 | 0.007 | 5.2602 | 0.0388 | 0.0012 | 0.0000 | 0.0012 | 11.2 | 0.00 |
| K-1420 OU | Acetone | 0.019 | 0.025 | 53.2970 | 1.3250 | 0.0397 | 0.0001 | 0.0398 | NA | NA |
| K-1420 OU | Aldrin | 0.011 | NA | 0.0250 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | NA | NA |
| K-1420 OU | Aluminum | 19950.00 | 49308.945 | 0.0040 | 197.2358 | 5.9171 | 137.7250 | 143.6421 | 33.2 | 4.33 |
| K-1420 OU | Barium | 31.850 | 83.938 | 0.1500 | 12.5908 | 0.3777 | 0.2344 | 0.6122 | 5.8 | 0.11 |
| K-1420 OU | Benzo(a)pyrene | 0.378 | 0.386 | 0.0115 | 0.0045 | 0.0001 | 0.0011 | 0.0012 | NA | NA |
| K-1420 OU | Beryllium | 0.375 | 1.290 | 0.0100 | 0.0129 | 0.0004 | 0.0036 | 0.0040 | NA | NA |
| K-1420 OU | Bis(2-ethylhexyl) phthalate | 0.215 | 0.289 | 0.0001 | 0.0000 | 0.0000 | 0.0008 | 0.0008 | 0.33 | 0.00 |
| K-1420 OU | Boron | 2.700 | NA | NA | NA | NA | 0.0075 | 0.0075 | 16.1 | 0.00 |

## Table G.11 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1420 OU | Chromium | 15.200 | 25.472 | 0.0410 | 1.0443 | 0.0313 | 0.0711 | 0.1025 | NA | NA |
| K-1420 OU | Copper | 26.200 | 47.035 | 0.4000 | 18.8142 | 0.5644 | 0.1314 | 0.6958 | 21 | 0.03 |
| K-1420 OU | Fluoride | 40.015 | 0.030 | 0.0600 | 0.0018 | 0.0001 | 0.0001 | 0.0001 | 2.5 | 0.00 |
| K-1420 OU | Lead | 66.250 | 90.518 | 0.0450 | 4.0733 | 0.1222 | 0.2528 | 0.3750 | 0.34 | 1.10 |
| K-1420 OU | Lithium | 52.200 | 228.354 | NA | NA | NA | 0.6378 | 0.6378 | NA | NA |
| K-1420 OU | Manganese | 470.000 | 1960.045 | 0.2500 | 490.0113 | 14.7003 | 5.4746 | 20.1749 | 230 | 0.09 |
| K-1420 OU | Mercury | 0.203 | 0.430 | 0.1430 | 0.0615 | 0.0018 | 0.0012 | 0.0030 | 0.004 | 0.76 |
| K-1420 OU | Methylene chloride | 0.007 | 0.009 | 6.8640 | 0.0642 | 0.0019 | 0.0000 | 0.0020 | NA | NA |
| K-1420 OU | Nitrate | 20.008 | 0.027 | NA | NA | NA | 0.0001 | 0.0001 | NA | NA |
| K-1420 OU | PCB-1254 | 0.663 | 1.693 | 0.0127 | 0.0215 | 0.0006 | 0.0047 | 0.0054 | 0.1 | 0.05 |
| K-1420 OU | Pentachlorophenol | 2.106 | NA | NA | NA | NA | 0.0059 | 0.0059 | NA | NA |

**Table G.11 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1420 OU | Strontium | 38.250 | 255.759 | NA | NA | NA | 0.7144 | 0.7144 | NA | NA |
| K-1420 OU | Tetrachloroethene | 0.006 | NA | 0.4106 | 0.0025 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| K-1420 OU | Thallium | 0.720 | NA | NA | NA | NA | 0.0020 | 0.0020 | NA | NA |
| K-1420 OU | Trichloroethene | 0.041 | NA | 1.5878 | 0.0651 | 0.0020 | 0.0001 | 0.0021 | NA | NA |
| K-1420 OU | Uranium | 139.109 | 282.563 | 0.0063 | 1.7801 | 0.0534 | 0.7892 | 0.8426 | 10 | 0.08 |
| K-1420 OU | Vanadium | 48.900 | 141.081 | 0.0060 | 0.8465 | 0.0254 | 0.3941 | 0.4194 | 6.7 | 0.06 |
| K-1420 OU | Zinc | 84.350 | 154.117 | 0.3701 | 57.0387 | 1.7112 | 0.4305 | 2.1416 | 10.1 | 0.21 |
| K-1420 OU | Beta-BHC | 0.014 | NA | 0.4340 | 0.0059 | 0.0002 | 0.0000 | 0.0002 | NA | NA |
| K-1414 | Acetone | 0.031 | NA | 53.2970 | 1.6522 | 0.0496 | 0.0001 | 0.0497 | NA | NA |
| K-1414 | Benzo(a)pyrene | 0.287 | NA | 0.0115 | 0.0033 | 0.0001 | 0.0008 | 0.0009 | NA | NA |
| K-1414 | Bis(2-ethylhexyl) phthalate | 0.224 | NA | 0.0001 | 0.0000 | 0.0000 | 0.0006 | 0.0006 | 0.33 | 0.00 |

**Table G.11 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-plant uptake factor* | Plant concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1414 | Di-n-butlyphthalate | 0.740 | 2.382 | 0.1656 | 0.3943 | 0.0118 | 0.0067 | 0.0185 | 0.03 | 0.62 |
| K-1414 | Methylene chloride | 0.038 | 0.158 | 6.8640 | 1.0842 | 0.0325 | 0.0004 | 0.0330 | NA | NA |
| K-1414 | Tetrachloroethene | 0.004 | NA | 0.4196 | 0.0017 | 0.0001 | 0.0000 | 0.0001 | NA | NA |
| CR OU2[a] | Aluminum | NA | 21900.0000 | 0.004 | 87.6 | 2.63 | 61.2 | 63.8 | 33.2 | 1.92 |
| CR OU2 | Arsenic | NA | 131.0000 | 0.004 | 1.77 | 0.0531 | 0.366 | 0.419 | 2.87 | 0.15 |
| CR OU2 | Barium | NA | 450.0000 | 0.150 | 67.5 | 2.03 | 1.26 | 3.28 | 5.80 | 0.57 |
| CR OU2 | Chromium | NA | 25.1000 | 0.041 | 5.30 | 0.159 | 0.0701 | 0.229 | 0.60 | 0.38 |
| CR OU2 | Copper | NA | 69.1000 | 0.400 | 27.6 | 0.829 | 0.193 | 1.02 | 21.0 | 0.05 |
| CR OU2 | Lead | NA | 18.8000 | 0.045 | 1.07 | 0.0321 | 0.525 | 0.0846 | 0.340 | 0.25 |
| CR OU2 | Manganese | NA | 152.0000 | 0.250 | 38.0 | 1.14 | 0.425 | 1.56 | 230 | 0.01 |
| CR OU2 | Mercury | NA | 0.7050 | 0.143 | 0.060 | 0.0018 | 0.00197 | 0.00377 | 0.004 | 0.94 |
| CR OU2 | Nickel | NA | 36.0000 | 0.060 | 2.16 | 0.0648 | 0.101 | 0.165 | 40.0 | 0.00 |
| CR OU2 | Selenium | NA | 14.8000 | 0.033 | 23.6 | 0.708 | 0.0413 | 0.750 | 0.300 | 2.50 |
| CR OU2 | Vanadium | NA | 84.9000 | 0.006 | 0.509 | 0.0153 | 0.237 | 0.252 | 6.70 | 0.04 |

## Table G.11 (continued)

| | | Soil concentration (mg/kg) | | | | Exposure estimate (mg/kg/d) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Mean | PLE 95% UCL | Soil-plant uptake factor* | Plant concentration (mg/kg) | Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
| CR OU2 | Zinc | NA | 53.9000 | 0.370 | 19.9 | 0.598 | 0.151 | 0.749 | 10.1 | 0.07 |
| CR OU2 | bis(2-Ethylhexyl) phthalate | NA | 0.2700 | 0.0001 | 2.70e-05 | 8.10e-07 | 7.54e-04 | 7.55e-04 | 0.330 | 0.00 |
| CR OU2 | alpha-BHC | NA | 0.0003 | 0.434 | 1.30e-04 | 3.91e-06 | 8.38e-07 | 4.74e-06 | 0.170 | 0.00 |

NA= Not Available
PLE UCB not available - contaminant detected in only 1 sample.
Soil to plant uptake factor not available, therefore, estimated vegetation concentrations and exposure from food ingestion could not be calculated.

* Soil to plant uptake factors for antimony, arsenic, cadmium, chromium, mercury, selenium, zinc, and uranium were calculated using data collected from Lower East Fork Poplar Creek. Other soil to plant uptake factors from Baes et al. 1984.

[a] Chestnut Ridge OU2 data available in the Baseline Ecological Risk Assessment for the Chestnut Ridge Operable Unit 2 Remedial Investigation/Feasibility Study. Measured contaminant concentrations in vegetation reported for arsenic, chromium, lead, mercury, and selenium.

## Table G.11 (continued)

### Total contaminant exposure for the wild turkey in WAG 5

| | | 95% UCL | | | | Exposure (mg/kg/d) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Analyte | Water mg/L | Soil mg/kg | Soil-Plant Uptake Factor * | Plant Concentration mg/kg | Water | Soil | Food | Total exposure | NOAEL Toxicity Benchmark mg/kg/d | NOAEL HQ |
| WAG 5 | Lead | 0 | 94 | 0.045 | 4.2300 | 0.0000 | 0.2626 | 0.1269 | 0.3895 | 0.34 | 1.15 |
| WAG 5 | Manganese | 4.09 | 1100 | 0.25 | 275.0000 | 0.1340 | 3.0724 | 8.2500 | 11.4564 | 230 | 0.05 |
| WAG 5 | Mercury | 0 | 1.3 | 0.143 | 0.1859 | 0.0000 | 0.0036 | 0.0056 | 0.0092 | 0.004 | 2.30 |
| WAG 5 | Nickel | 0.57 | 34 | 0.06 | 2.0400 | 0.0187 | 0.0950 | 0.0612 | 0.1748 | 40 | 0.00 |
| WAG 5 | Selenium | 0.24 | 0 | 0.033 | 0.0000 | 0.0079 | 0.0000 | 0.0000 | 0.0079 | 0.3 | 0.03 |
| WAG 5 | Vanadium | 0.09 | 34 | 0.006 | 0.2040 | 0.0029 | 0.0950 | 0.0061 | 0.1040 | 6.7 | 0.02 |
| WAG 5 | Zinc | 0.03 | 1000 | 0.3701 | 370.1000 | 0.0010 | 2.7931 | 11.1030 | 13.8971 | 10.1 | 1.38 |
| WAG 5 | Aroclor 1254 | 0 | 0.24 | 0.0127 | 0.0030 | 0.0000 | 0.0007 | 0.0001 | 0.0008 | 0.1 | 0.01 |
| WAG 5 | Aroclor 1260 | 0 | 0.18 | 0.0029 | 0.0005 | 0.0000 | 0.0005 | 0.0000 | 0.0005 | 0.1 | 0.01 |
| WAG 5 | Bis(2-Ethylhexyl) Phthalate | 0 | 1.3 | 0.0001 | 0.0001 | 0.0000 | 0.0036 | 0.0000 | 0.0036 | 0.33 | 0.01 |
| WAG 5 | Di-n-butyl Phthalate | 0 | 1.5 | 0.1656 | 0.2484 | 0.0000 | 0.0042 | 0.0075 | 0.0116 | 0.03 | 0.39 |
| WAG 5 | Trichloroethene | 0.13 | 0 | 0.4196 | 0.0000 | 0.0043 | 0.0000 | 0.0000 | 0.0043 | NA | ERR |

* Soil to plant uptake factors for antimony, arsenic, cadmium, chromium, mercury, selenium, zinc, and uranium were calculated using data collected from Lower East Fork Poplar Creek. Other soil to plant uptake factors from Baes et al. 1984.

**Table G.12. Total contaminant exposure and NOAEL HQs for the short-tailed shrew on the ORR**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | 4,4-DDE | 0.108 | NA | NA | NA | NA | 0.008 | 0.008 | 2.26 | 0.00 |
| BCVOU1 | 4,4-DDT | 0.108 | NA | NA | NA | NA | 0.008 | 0.008 | 2.26 | 0.00 |
| BCVOU1 | Acetone | 0.036 | 0.043 | NA | NA | NA | 0.003 | 0.003 | 28.3 | 0.00 |
| BCVOU1 | Antimony | 1.03 | 1.74 | NA | NA | NA | 0.135 | 0.135 | 0.157 | 0.86 |
| BCVOU1 | Arsenic | 9.27 | 13.35 | 0.632 | 8.44 | 5.06 | 1.04 | 6.11 | 0.158 | 38.65 |
| BCVOU1 | Barium | 264.32 | 403.01 | 0.078 | 31.31 | 18.79 | 31.43 | 50.22 | 15.5 | 3.24 |
| BCVOU1 | Benzo(a)pyrene | 10.81 | 19.90 | NA | NA | NA | 1.552 | 1.552 | 1.26 | 1.23 |
| BCVOU1 | Beryllium | 1.05 | 1.43 | 1.305 | 1.864 | 1.119 | 0.111 | 1.230 | 1.87 | 0.66 |
| BCVOU1 | Bis(2-ethylhexyl) phthalate | 3.33 | 0.59 | NA | NA | NA | 0.046 | 0.046 | 23 | 0.00 |
| BCVOU1 | Cadmium | 5.38 | 10.74 | 4.812 | 51.66 | 31.00 | 0.84 | 31.83 | 0.023 | 1384.10 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | Chloroform | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | 42.4 | 0.00 |
| BCVOU1 | Chromium | 48.98 | 68.36 | 0.289 | 19.77 | 11.86 | 5.33 | 17.19 | 9.27 | 1.85 |
| BCVOU1 | Copper | 972.06 | 1780.00 | NA | NA | NA | 138.84 | 138.84 | 46.8 | 2.97 |
| BCVOU1 | Di-n-butylphthalate | 3.00 | 0.32 | NA | NA | NA | 0.025 | 0.025 | 691 | 0.00 |
| BCVOU1 | Lead | 287.46 | 543.25 | NA | NA | NA | 42.373 | 42.373 | 22.6 | 1.87 |
| BCVOU1 | Mercury | 18.98 | 31.84 | 5.767 | 183.63 | 110.18 | 2.48 | 112.66 | 0.09 | 1251.80 |
| BCVOU1 | Methylene chloride | 0.017 | 0.023 | NA | NA | NA | 0.002 | 0.002 | 16.54 | 0.00 |
| BCVOU1 | Molybdenum | 8.86 | 18.20 | NA | NA | NA | 1.420 | 1.420 | 0.33 | 4.30 |
| BCVOU1 | Nickel | 85.11 | 137.53 | NA | NA | NA | 10.727 | 10.727 | 113.1 | 0.09 |
| BCVOU1 | PCB-1254 | 1.79 | 2.66 | 7.107 | 18.94 | 11.36 | 0.21 | 11.57 | 0.066 | 175.29 |
| BCVOU1 | PCB-1260 | 3.65 | 6.74 | 7.107 | 47.90 | 28.74 | 0.53 | 29.27 | 0.066 | 443.45 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BCVOU1 | Selenium | 1.75 | 2.27 | NA | NA | NA | 0.177 | 0.177 | 0.096 | 1.84 |
| BCVOU1 | Tetrachloroethene | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | 1.8 | 0.00 |
| BCVOU1 | Tin | 20.52 | 34.43 | NA | NA | NA | 2.685 | 2.685 | 29.4 | 0.09 |
| BCVOU1 | Toluene | 0.314 | 0.399 | NA | NA | NA | 0.031 | 0.031 | 32.7 | 0.00 |
| BCVOU1 | Zinc | 668.91 | 1133.31 | 5.590 | 6334.84 | 3800.90 | 88.40 | 3889.30 | 452 | 8.60 |
| LEFPC | 4,4-DDD | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| LEFPC | 4,4-DDE | 0.015 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| LEFPC | 4,4-DDT | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| LEFPC | Acetone | 0.254 | 0.577 | NA | NA | NA | 0.045 | 0.045 | 28.3 | 0.00 |
| LEFPC | Aldrin | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 0.57 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | Antimony | 1.284 | 0.787 | NA | NA | NA | 0.061 | 0.061 | 0.157 | 0.39 |
| LEFPC | Barium | 121.36 | 130.05 | 0.078 | 10.10 | 6.06 | 10.14 | 16.21 | 15.5 | 1.05 |
| LEFPC | Benzo(a)pyrene | 0.492 | 0.484 | NA | NA | NA | 0.038 | 0.038 | 1.26 | 0.03 |
| LEFPC | Bis(2-ethylhexyl) phthalate | 0.334 | 0.201 | NA | NA | NA | 0.016 | 0.016 | 23 | 0.00 |
| LEFPC | Cadmium | 4.09 | 4.64 | 4.812 | 22.35 | 13.41 | 0.36 | 13.77 | 0.023 | 598.76 |
| LEFPC | Chromium | 64.61 | 65.53 | 0.289 | 18.95 | 11.37 | 5.11 | 16.48 | 9.27 | 1.78 |
| LEFPC | Copper | 78.03 | 89.67 | NA | NA | NA | 6.994 | 6.994 | 46.8 | 0.15 |
| LEFPC | Cyanide | 3.02 | 5.82 | NA | NA | NA | 0.454 | 0.454 | 179 | 0.00 |
| LEFPC | Di-n-butlyphthalate | 0.421 | 0.184 | NA | NA | NA | 0.014 | 0.014 | 691 | 0.00 |
| LEFPC | Dieldrin | 0.017 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 0.057 | 0.00 |
| LEFPC | Diethylphthalate | 0.461 | 0.173 | NA | NA | NA | 0.014 | 0.014 | 5761 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | Endosulfan I | 0.008 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.42 | 0.00 |
| LEFPC | Endosulfan II | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.42 | 0.00 |
| LEFPC | Endrin | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.116 | 0.00 |
| LEFPC | Heptachlor | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 0.4 | 0.00 |
| LEFPC | Lead | 53.80 | 61.49 | NA | NA | NA | 4.796 | 4.796 | 22.6 | 0.21 |
| LEFPC | Lindane | 0.008 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 22.6 | 0.00 |
| LEFPC | Mercury | 38.49 | 41.61 | 5.77 | 239.95 | 143.97 | 3.25 | 147.22 | 0.09 | 1635.75 |
| LEFPC | Methoxychlor | 0.083 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 11.3 | 0.00 |
| LEFPC | Methylene chloride | 0.037 | 0.053 | NA | NA | NA | 0.004 | 0.004 | 16.54 | 0.00 |
| LEFPC | Nickel | 34.37 | 37.91 | NA | NA | NA | 2.957 | 2.957 | 113.1 | 0.03 |
| LEFPC | PCB-1016 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | 5.48 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | PCB-1242 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | 0.276 | 0.01 |
| LEFPC | PCB-1248 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | 0.07 | 0.06 |
| LEFPC | PCB-1254 | 0.258 | 0.224 | 7.107 | 1.591 | 0.955 | 0.017 | 0.972 | 0.066 | 14.73 |
| LEFPC | PCB-1260 | 0.431 | 0.465 | 7.107 | 3.308 | 1.985 | 0.036 | 2.021 | 0.066 | 30.62 |
| LEFPC | Pentachlorophenol | 1.692 | 0.377 | NA | NA | NA | 0.029 | 0.029 | 0.68 | 0.04 |
| LEFPC | Selenium | 13.566 | 8.704 | 7.42 | 64.55 | 38.73 | 0.679 | 39.409 | 0.096 | 410.51 |
| LEFPC | Thallium | 0.81 | NA | NA | NA | NA | 0.063 | 0.063 | 0.021 | 3.01 |
| LEFPC | Uranium | 9.71 | 11.89 | NA | NA | NA | 0.928 | 0.928 | 3.77 | 0.25 |
| LEFPC | Zinc | 179.91 | 166.20 | 5.59 | 929.00 | 557.40 | 12.96 | 570.37 | 452 | 1.26 |
| LEFPC | Alpha-chlordane | 0.073 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |
| LEFPC | Delta-BHC | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 4.5 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| LEFPC | Gamma-chlordane | 0.073 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |
| K-1407 OU | 1,1,1-trichlorethane | 0.015 | NA | NA | NA | NA | 0.001 | 0.001 | 1323 | 0.00 |
| K-1407 OU | 1,2-Dichlorethene | 0.017 | 0.028 | NA | NA | NA | 0.002 | 0.002 | 56.8 | 0.00 |
| K-1407 OU | Acetone | 0.028 | 0.019 | NA | NA | NA | 0.001 | 0.001 | 28.3 | 0.00 |
| K-1407 OU | Aluminum | 26562.96 | 28723.53 | 0.032 | 910.54 | 546.32 | 2240.44 | 2786.76 | 2.43 | 1146.81 |
| K-1407 OU | Antimony | 7.15 | NA | NA | NA | NA | 0.558 | 0.558 | 0.157 | 3.55 |
| K-1407 OU | Arsenic | 12.43 | 13.07 | 0.632 | 8.26 | 4.96 | 1.02 | 5.98 | 0.158 | 37.82 |
| K-1407 OU | Barium | 110.49 | 125.28 | 0.078 | 9.73 | 5.84 | 9.77 | 15.61 | 15.5 | 1.01 |
| K-1407 OU | Beryllium | 1.016 | 1.127 | 1.305 | 1.471 | 0.882 | 0.088 | 0.970 | 1.87 | 0.52 |
| K-1407 OU | Boron | 6.419 | 8.400 | NA | NA | NA | 0.655 | 0.655 | 79.2 | 0.01 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1407 OU | Cadmium | 1.880 | 2.149 | 4.812 | 10.34 | 6.21 | 0.17 | 6.37 | 0.023 | 277.07 |
| K-1407 OU | Chloroform | 0.016 | 0.012 | NA | NA | NA | 0.00 | 0.00 | 42.4 | 0.00 |
| K-1407 OU | Chromium | 61.04 | 69.86 | 0.289 | 20.20 | 12.12 | 5.45 | 17.57 | 9.27 | 1.90 |
| K-1407 OU | Copper | 40.85 | 48.64 | NA | NA | NA | 3.794 | 3.794 | 46.8 | 0.08 |
| K-1407 OU | Di-n-butylphthalate | 0.017 | 0.018 | NA | NA | NA | 0.001 | 0.001 | 691 | 0.00 |
| K-1407 OU | Lead | 30.68 | 33.00 | NA | NA | NA | 2.57 | 2.57 | 22.6 | 0.11 |
| K-1407 OU | Mercury | 4.73 | 6.40 | 5.767 | 36.89 | 22.13 | 0.50 | 22.63 | 0.09 | 251.46 |
| K-1407 OU | Methylene chloride | 0.018 | 0.021 | NA | NA | NA | 0.002 | 0.002 | 16.54 | 0.00 |
| K-1407 OU | Nickel | 192.18 | 251.09 | NA | NA | NA | 19.59 | 19.59 | 113.1 | 0.17 |
| K-1407 OU | Selenium | 7.15 | NA | 7.416 | 53.04 | 31.82 | 0.558 | 32.379 | 0.096 | 337.29 |
| K-1407 OU | Strontium | 18.14 | 20.67 | NA | NA | NA | 1.612 | 1.612 | 744 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1407 OU | Tetrachloroethene | 0.023 | 0.024 | NA | NA | NA | 0.002 | 0.002 | 1.8 | 0.00 |
| K-1407 OU | Toluene | 0.011 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 32.7 | 0.00 |
| K-1407 OU | Trichloroethene | 0.025 | 0.028 | NA | NA | NA | 0.002 | 0.002 | 0.88 | 0.00 |
| K-1407 OU | Uranium | 143.69 | 255.85 | NA | NA | NA | 19.956 | 19.956 | 3.77 | 5.29 |
| K-1407 OU | Zinc | 59.78 | 64.47 | 5.59 | 360.37 | 216.22 | 5.03 | 221.25 | 452 | 0.49 |
| WAG 1 | 1,1,1-trichlorethane | 0.008 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1323 | 0.00 |
| WAG 1 | 1,1-Dichlorethene | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 84.8 | 0.00 |
| WAG 1 | 1,2-Dichlorethane | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 66 | 0.00 |
| WAG 1 | 1,2-Dichlorethene | 0.008 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 56.8 | 0.00 |
| WAG 1 | 4,4-DDD | 0.021 | NA | NA | NA | NA | 0.002 | 0.002 | 2.26 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | 4,4-DDE | 0.022 | NA | NA | NA | NA | 0.002 | 0.002 | 2.26 | 0.00 |
| WAG 1 | 4,4-DDT | 0.021 | 0.010 | NA | NA | NA | 0.001 | 0.001 | 2.26 | 0.00 |
| WAG 1 | Acetone | 0.028 | 0.029 | NA | NA | NA | 0.002 | 0.002 | 28.3 | 0.00 |
| WAG 1 | Antimony | 6.13 | 6.06 | NA | NA | NA | 0.473 | 0.473 | 0.157 | 3.01 |
| WAG 1 | Arsenic | 9.01 | 9.77 | 0.632 | 6.176 | 3.706 | 0.762 | 4.468 | 0.158 | 28.28 |
| WAG 1 | Benzene | 0.008 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 33.13 | 0.00 |
| WAG 1 | Benzo(a)pyrene | 0.678 | 0.726 | NA | NA | NA | 0.057 | 0.057 | 1.26 | 0.04 |
| WAG 1 | Beryllium | 0.949 | 1.013 | 1.31 | 1.32 | 0.793 | 0.079 | 0.872 | 1.87 | 0.47 |
| WAG 1 | Bis(2-ethylhexyl) phthalate | 0.458 | 0.441 | NA | NA | NA | 0.034 | 0.034 | 23 | 0.00 |
| WAG 1 | Boron | 1204.97 | 1761.23 | NA | NA | NA | 137.38 | 137.38 | 79.2 | 1.73 |
| WAG 1 | Cadmium | 1.770 | 1.962 | 4.81 | 9.44 | 5.664 | 0.153 | 5.817 | 0.023 | 252.91 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) Mean | PLE 95% UCL | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) Food | Soil | Total | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| WAG 1 | Carbon tetrachloride | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 45.2 | 0.00 |
| WAG 1 | Chloroform | 0.010 | 0.009 | NA | NA | NA | 0.001 | 0.001 | 42.4 | 0.00 |
| WAG 1 | Chromium | 28.95 | 32.96 | 0.289 | 9.531 | 5.719 | 2.571 | 8.290 | 9.27 | 0.89 |
| WAG 1 | Copper | 19.62 | 22.26 | NA | NA | NA | 1.736 | 1.736 | 46.8 | 0.04 |
| WAG 1 | Cyanide | 4.681 | NA | NA | NA | NA | 0.365 | 0.365 | 179 | 0.00 |
| WAG 1 | Di-n-butlyphthalate | 0.720 | 0.700 | NA | NA | NA | 0.055 | 0.055 | 691 | 0.00 |
| WAG 1 | Diethylphthalate | 0.579 | 0.048 | NA | NA | NA | 0.004 | 0.004 | 5761 | 0.00 |
| WAG 1 | Endrin | 0.021 | NA | NA | NA | NA | 0.002 | 0.002 | 0.116 | 0.01 |
| WAG 1 | Heptachlor | 0.011 | NA | NA | NA | NA | 0.001 | 0.001 | 0.4 | 0.00 |
| WAG 1 | Lead | 40.87 | 46.32 | NA | NA | NA | 3.613 | 3.613 | 22.6 | 0.16 |
| WAG 1 | Mercury | 1.306 | 1.850 | 5.767 | 10.667 | 6.400 | 0.144 | 6.544 | 0.09 | 72.71 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | Methylene chloride | 0.031 | 0.037 | NA | NA | NA | 0.003 | 0.003 | 16.54 | 0.00 |
| WAG 1 | PCB-1254 | 0.350 | 0.440 | 7.107 | 3.129 | 1.878 | 0.034 | 1.912 | 0.066 | 28.97 |
| WAG 1 | PCB-1260 | 0.247 | 0.227 | 7.107 | 1.613 | 0.968 | 0.018 | 0.986 | 0.066 | 14.94 |
| WAG 1 | Pentachlorophenol | 2.957 | 0.280 | NA | NA | NA | 0.022 | 0.022 | 0.68 | 0.03 |
| WAG 1 | Selenium | 14.57 | 16.84 | 7.416 | 124.89 | 74.93 | 1.314 | 76.248 | 0.096 | 794.2 |
| WAG 1 | Tetrachloroethene | 0.008 | 0.004 | NA | NA | NA | 0.000 | 0.000 | 1.8 | 0.00 |
| WAG 1 | Thallium | 14.17 | 15.85 | NA | NA | NA | 1.236 | 1.236 | 0.021 | 58.87 |
| WAG 1 | Tin | 50.73 | 54.20 | NA | NA | NA | 4.228 | 4.228 | 29.4 | 0.14 |
| WAG 1 | Toluene | 0.007 | 0.004 | NA | NA | NA | 0.000 | 0.000 | 32.7 | 0.00 |
| WAG 1 | Trichloroethene | 0.007 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 0.88 | 0.00 |
| WAG 1 | Uranium | 7.96 | 14.47 | NA | NA | NA | 1.129 | 1.129 | 3.77 | 0.30 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 1 | Vinyl chloride | 0.015 | 0.012 | NA | NA | NA | 0.001 | 0.001 | 0.48 | 0.00 |
| WAG 1 | Zinc | 91.99 | 105.63 | 5.59 | 590.43 | 354.26 | 8.24 | 362.50 | 452 | 0.80 |
| WAG 1 | Alpha-BHC | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | 4.5 | 0.00 |
| WAG 1 | Alpha-chlordane | 0.105 | NA | NA | NA | NA | 0.008 | 0.008 | 5.8 | 0.00 |
| WAG 1 | Gamma-chlordane | 0.104 | NA | NA | NA | NA | 0.008 | 0.008 | 5.8 | 0.00 |
| WAG 6 | 1,2-Dichlorethene | 0.007 | NA | NA | NA | NA | 0.001 | 0.001 | 56.8 | 0.00 |
| WAG 6 | 1,4-Dioxane | 6.675 | 7.559 | NA | NA | NA | 0.590 | 0.590 | 1.4 | 0.42 |
| WAG 6 | Acetone | 0.014 | 0.015 | NA | NA | NA | 0.001 | 0.001 | 28.3 | 0.00 |
| WAG 6 | Barium | 132.81 | 143.47 | 0.078 | 11.148 | 6.689 | 11.191 | 17.879 | 15.5 | 1.15 |
| WAG 6 | Beryllium | 1.383 | 1.486 | 1.305 | 1.939 | 1.164 | 0.116 | 1.280 | 1.87 | 0.68 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| WAG 6 | Bis(2-ethylhexyl) phthalate | 0.398 | 0.462 | NA | NA | NA | 0.036 | 0.036 | 23 | 0.00 |
| WAG 6 | Cadmium | 2.501 | 2.846 | 4.812 | 13.69 | 8.22 | 0.222 | 8.437 | 0.023 | 366.84 |
| WAG 6 | Chloroform | 0.011 | 0.013 | NA | NA | NA | 0.001 | 0.001 | 42.4 | 0.00 |
| WAG 6 | Cyanide | 23.82 | NA | NA | NA | NA | 1.858 | 1.858 | 179 | 0.01 |
| WAG 6 | Methylene chloride | 0.028 | 0.038 | NA | NA | NA | 0.003 | 0.003 | 16.54 | 0.00 |
| WAG 6 | Nickel | 38.28 | 41.63 | NA | NA | NA | 3.247 | 3.247 | 113.1 | 0.03 |
| WAG 6 | Tetrachloroethene | 0.006 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1.8 | 0.00 |
| WAG 6 | Tin | 55.03 | 89.24 | NA | NA | NA | 6.961 | 6.961 | 29.4 | 0.24 |
| WAG 6 | Toluene | 0.004 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 32.7 | 0.00 |
| WAG 6 | Trichloroethene | 0.005 | 0.004 | NA | NA | NA | 0.000 | 0.000 | 0.88 | 0.00 |
| WAG 6 | Uranium | 0.818 | 1.007 | NA | NA | NA | 0.079 | 0.079 | 3.77 | 0.02 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| UEFPC OU 2 | Aluminum | 29900.00 | 65257.01 | 0.032 | 2068.65 | 1241.19 | 5090.05 | 6331.23 | 2.43 | 2605.45 |
| UEFPC OU 2 | Barium | 149.85 | 567.50 | 0.078 | 44.10 | 26.46 | 44.27 | 70.72 | 15.5 | 4.56 |
| UEFPC OU 2 | Beryllium | 1.25 | 2.20 | 1.305 | 2.868 | 1.721 | 0.171 | 1.892 | 1.87 | 1.01 |
| UEFPC OU 2 | Chromium | 39.70 | 76.95 | 0.289 | 22.25 | 13.35 | 6.002 | 19.35 | 9.27 | 2.09 |
| UEFPC OU 2 | Copper | 22.10 | 54.93 | NA | NA | NA | 4.285 | 4.285 | 46.8 | 0.09 |
| UEFPC OU 2 | Lead | 36.60 | 250.00 | NA | NA | NA | 19.500 | 19.500 | 22.6 | 0.86 |
| UEFPC OU 2 | Lithium | 22.70 | 31.54 | NA | NA | NA | 2.460 | 2.460 | 26.6 | 0.09 |
| UEFPC OU 2 | Manganese | 484.00 | 2592.79 | NA | NA | NA | 202.24 | 202.24 | 249 | 0.81 |
| UEFPC OU 2 | Nickel | 36.20 | 57.04 | NA | NA | NA | 4.449 | 4.449 | 113.1 | 0.04 |
| UEFPC OU 2 | Nitrate | 0.585 | 1.122 | NA | NA | NA | 0.087 | 0.087 | 1929 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| UEFPC OU 2 | Strontium | 21.10 | 117.70 | NA | NA | NA | 9.181 | 9.181 | 744 | 0.01 |
| UEFPC OU 2 | Uranium | 1.57 | 6.21 | NA | NA | NA | 0.484 | 0.484 | 3.77 | 0.13 |
| UEFPC OU 2 | Zinc | 86.20 | 286.98 | 5.590 | 1604.12 | 962.47 | 22.38 | 984.85 | 452 | 2.18 |
| BC OU 2 | 1,1,1-trichlorethane | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 1323 | 0.00 |
| BC OU 2 | 1,1-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 84.8 | 0.00 |
| BC OU 2 | 1,2-Dichlorethane | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 66 | 0.00 |
| BC OU 2 | 1,2-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 56.8 | 0.00 |
| BC OU 2 | 4,4-DDD | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| BC OU 2 | 4,4-DDE | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| BC OU 2 | 4,4-DDT | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Acetone | 0.051 | 0.105 | NA | NA | NA | 0.008 | 0.008 | 28.3 | 0.00 |
| BC OU 2 | Aldrin | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 0.57 | 0.00 |
| BC OU 2 | Aluminum | 26143.85 | 35920.34 | 0.032 | 1138.67 | 683.20 | 2801.79 | 3484.99 | 2.43 | 1434.15 |
| BC OU 2 | Antimony | 0.309 | 0.357 | NA | NA | NA | 0.028 | 0.028 | 0.157 | 0.18 |
| BC OU 2 | Arsenic | 33.37 | 35.09 | 0.632 | 22.19 | 13.31 | 2.737 | 16.05 | 0.158 | 101.57 |
| BC OU 2 | Barium | 101.40 | 153.98 | 0.078 | 11.96 | 7.18 | 12.01 | 19.19 | 15.5 | 1.24 |
| BC OU 2 | Benzene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 33.13 | 0.00 |
| BC OU 2 | Benzo(a)pyrene | 0.499 | 0.529 | NA | NA | NA | 0.041 | 0.041 | 1.26 | 0.03 |
| BC OU 2 | Beryllium | 1.025 | 1.315 | 1.305 | 1.717 | 1.030 | 0.103 | 1.133 | 1.87 | 0.61 |
| BC OU 2 | Bis(2-ethylhexyl) phthalate | 0.499 | 0.529 | NA | NA | NA | 0.041 | 0.041 | 23 | 0.00 |
| BC OU 2 | Boron | 65.50 | 79.41 | NA | NA | NA | 6.194 | 6.194 | 79.2 | 0.08 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Cadmium | 1.247 | 0.857 | 4.812 | 4.124 | 2.475 | 0.067 | 2.542 | 0.023 | 110.50 |
| BC OU 2 | Carbon tetrachloride | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 45.2 | 0.00 |
| BC OU 2 | Chloroform | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 42.4 | 0.00 |
| BC OU 2 | Chromium | 37.33 | 44.23 | 0.289 | 12.79 | 7.675 | 3.450 | 11.125 | 9.27 | 1.20 |
| BC OU 2 | Copper | 39.22 | 57.37 | NA | NA | NA | 4.474 | 4.474 | 46.8 | 0.10 |
| BC OU 2 | Di-n-butlyphthalate | 0.499 | 0.529 | NA | NA | NA | 0.041 | 0.041 | 691 | 0.00 |
| BC OU 2 | Dieldrin | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.057 | 0.01 |
| BC OU 2 | Diethylphthalate | 0.499 | 0.529 | NA | NA | NA | 0.041 | 0.041 | 5761 | 0.00 |
| BC OU 2 | Endosulfan I | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 0.42 | 0.00 |
| BC OU 2 | Endosulfan II | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.42 | 0.00 |
| BC OU 2 | Endrin | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.116 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Heptachlor | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 0.4 | 0.00 |
| BC OU 2 | Lead | 81.02 | 126.82 | NA | NA | NA | 9.892 | 9.892 | 22.6 | 0.44 |
| BC OU 2 | Lindane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 22.6 | 0.00 |
| BC OU 2 | Lithium | 39.25 | 47.19 | NA | NA | NA | 3.681 | 3.681 | 26.6 | 0.14 |
| BC OU 2 | Manganese | 1021.52 | 1779.37 | NA | NA | NA | 138.79 | 138.79 | 249 | 0.56 |
| BC OU 2 | Mercury | 49.019 | 76.055 | 5.767 | 438.60 | 263.16 | 5.93 | 269.09 | 0.09 | 2989.94 |
| BC OU 2 | Methoxychlor | 0.026 | 0.028 | NA | NA | NA | 0.002 | 0.002 | 11.3 | 0.00 |
| BC OU 2 | Methylene chloride | 0.016 | 0.018 | NA | NA | NA | 0.001 | 0.001 | 16.54 | 0.00 |
| BC OU 2 | Nickel | 32.600 | 50.322 | NA | NA | NA | 3.925 | 3.925 | 113.1 | 0.03 |
| BC OU 2 | Niobium | 9.850 | NA | NA | NA | NA | 0.768 | 0.768 | 0.195 | 3.94 |
| BC OU 2 | PCB-1016 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | 5.48 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | PCB-1242 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | 0.276 | 0.02 |
| BC OU 2 | PCB-1248 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | 0.07 | 0.06 |
| BC OU 2 | PCB-1254 | 0.052 | 0.056 | 7.107 | 0.401 | 0.241 | 0.004 | 0.245 | 0.066 | 3.71 |
| BC OU 2 | PCB-1260 | 0.042 | 0.048 | 7.107 | 0.338 | 0.203 | 0.004 | 0.206 | 0.066 | 3.13 |
| BC OU 2 | Pentachlorophenol | 1.211 | 1.296 | NA | NA | NA | 0.101 | 0.101 | 0.68 | 0.15 |
| BC OU 2 | Selenium | 1.094 | 1.788 | 7.416 | 13.26 | 7.956 | 0.139 | 8.096 | 0.096 | 84.33 |
| BC OU 2 | Strontium | 109.93 | 133.87 | NA | NA | NA | 10.44 | 10.44 | 744 | 0.01 |
| BC OU 2 | Tetrachloroethene | 0.007 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 1.8 | 0.00 |
| BC OU 2 | Toluene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 32.7 | 0.00 |
| BC OU 2 | Toxaphene | 0.261 | 0.284 | NA | NA | NA | 0.022 | 0.022 | 22.6 | 0.00 |
| BC OU 2 | Trichloroethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 0.88 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| BC OU 2 | Uranium | 2.041 | 2.517 | NA | NA | NA | 0.196 | 0.196 | 3.77 | 0.05 |
| BC OU 2 | Vanadium | 54.838 | 62.578 | NA | NA | NA | 4.881 | 4.881 | 0.54 | 9.04 |
| BC OU 2 | Vinyl chloride | 0.015 | 0.016 | NA | NA | NA | 0.001 | 0.001 | 0.48 | 0.00 |
| BC OU 2 | Zinc | 113.21 | 149.42 | 5.590 | 835.20 | 501.12 | 11.65 | 512.78 | 452 | 1.13 |
| BC OU 2 | Zirconium | 59.25 | 74.48 | NA | NA | NA | 5.810 | 5.810 | 2.19 | 2.65 |
| BC OU 2 | Alpha-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 4.5 | 0.00 |
| BC OU 2 | Alpha-chlordane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |
| BC OU 2 | Beta-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1.1 | 0.00 |
| BC OU 2 | Delta-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 4.5 | 0.00 |
| BC OU 2 | Gamma-chlordane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | 1,1,1-trichlorethane | 0.436 | 0.955 | NA | NA | NA | 0.074 | 0.074 | 1323 | 0.00 |
| SCF | 1,1-Dichlorethene | 10.46 | 19.68 | NA | NA | NA | 1.535 | 1.535 | 84.8 | 0.02 |
| SCF | 1,2-Dichlorethane | 60.89 | 157.22 | NA | NA | NA | 12.26 | 12.26 | 66 | 0.19 |
| SCF | 4,4-DDD | 0.005 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 56.8 | 0.00 |
| SCF | 4,4-DDE | 0.003 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 2.26 | 0.00 |
| SCF | 4,4-DDT | 0.006 | 0.006 | NA | NA | NA | 0.001 | 0.001 | 2.26 | 0.00 |
| SCF | Acetone | 97.955 | 212.986 | NA | NA | NA | 16.613 | 16.613 | 2.26 | 7.35 |
| SCF | Aldrin | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 28.3 | 0.00 |
| SCF | Aluminum | 16294.05 | 20546.94 | 0.032 | 651.34 | 390.80 | 1602.66 | 1993.46 | 0.57 | 3497.31 |
| SCF | Antimony | 3.125 | 1.215 | NA | NA | NA | 0.095 | 0.095 | 2.43 | 0.04 |
| SCF | Arsenic | 12.77 | 14.53 | 0.632 | 9.189 | 5.513 | 1.134 | 6.647 | 0.158 | 42.07 |
| SCF | Barium | 111.60 | 139.74 | 0.078 | 10.86 | 6.51 | 10.90 | 17.41 | 15.5 | 1.12 |
| SCF | Benzene | 0.916 | 2.040 | NA | NA | NA | 0.159 | 0.159 | 33.13 | 0.00 |
| SCF | Benzo(a)pyrene | 0.483 | 0.322 | NA | NA | NA | 0.025 | 0.025 | 1.26 | 0.02 |
| SCF | Beryllium | 1.480 | 1.611 | 1.305 | 2.103 | 1.262 | 0.126 | 1.388 | 1.87 | 0.74 |
| SCF | Bis(2-ethylhexyl) phthalate | 0.439 | 0.176 | NA | NA | NA | 0.014 | 0.014 | 23 | 0.00 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | Cadmium | 6.132 | 7.413 | 4.812 | 35.67 | 21.40 | 0.58 | 21.98 | 0.023 | 955.66 |
| SCF | Carbon tetrachloride | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 45.2 | 0.00 |
| SCF | Chloroform | 0.886 | 1.987 | NA | NA | NA | 0.155 | 0.155 | 42.4 | 0.00 |
| SCF | Chromium | 56.89 | 61.16 | 0.289 | 17.69 | 10.61 | 4.77 | 15.38 | 9.27 | 1.66 |
| SCF | Copper | 20.55 | 27.90 | NA | NA | NA | 2.176 | 2.176 | 46.8 | 0.05 |
| SCF | Di-n-butlyphthalate | 0.470 | 0.118 | NA | NA | NA | 0.009 | 0.009 | 691 | 0.00 |
| SCF | Dieldrin | 0.004 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.057 | 0.00 |
| SCF | Endosulfan I | 0.003 | NA | NA | NA | NA | 0.000 | 0.000 | 0.42 | 0.00 |
| SCF | Endrin | 0.005 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.116 | 0.00 |
| SCF | Heptachlor | 0.003 | NA | NA | NA | NA | 0.000 | 0.000 | 0.4 | 0.00 |
| SCF | Lead | 41.51 | 52.21 | NA | NA | NA | 4.073 | 4.073 | 22.6 | 0.18 |
| SCF | Manganese | 1392.09 | 1849.26 | NA | NA | NA | 144.24 | 144.24 | 249 | 0.58 |
| SCF | Mercury | 0.682 | 0.854 | 5.767 | 4.926 | 2.956 | 0.067 | 3.022 | 0.09 | 33.58 |
| SCF | Methoxychlor | 0.027 | 0.014 | NA | NA | NA | 0.001 | 0.001 | 11.3 | 0.00 |
| SCF | Methylene chloride | 136.18 | 281.15 | NA | NA | NA | 21.930 | 21.930 | 16.54 | 1.33 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| SCF | Nickel | 18.42 | 20.37 | NA | NA | NA | 1.589 | 1.589 | 113.1 | 0.01 |
| SCF | PCB-1254 | 0.057 | 0.038 | 7.107 | 0.267 | 0.160 | 0.003 | 0.163 | 0.066 | 2.47 |
| SCF | PCB-1260 | 0.066 | 0.069 | 7.107 | 0.493 | 0.296 | 0.005 | 0.301 | 0.066 | 4.57 |
| SCF | Pentachlorophenol | 0.266 | 0.005 | NA | NA | NA | 0.000 | 0.000 | 0.68 | 0.00 |
| SCF | Selenium | 2.796 | 2.965 | 7.416 | 21.98 | 13.19 | 0.231 | 13.42 | 0.096 | 139.81 |
| SCF | Tetrachloroethene | 0.546 | 1.142 | NA | NA | NA | 0.089 | 0.089 | 1.8 | 0.05 |
| SCF | Toluene | 0.917 | 2.045 | NA | NA | NA | 0.160 | 0.160 | 32.7 | 0.00 |
| SCF | Trichloroethene | 0.782 | 1.493 | NA | NA | NA | 0.116 | 0.116 | 0.88 | 0.13 |
| SCF | Uranium | 3.128 | 3.313 | NA | NA | NA | 0.258 | 0.258 | 3.77 | 0.07 |
| SCF | Zinc | 114.17 | 146.03 | 5.590 | 816.27 | 489.76 | 11.39 | 501.15 | 452 | 1.11 |
| SCF | Alpha-chlordane | 0.003 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |
| SCF | Delta-BHC | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 4.5 | 0.00 |
| SCF | Gamma-chlordane | 0.003 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 5.8 | 0.00 |
| K-1420 OU | 1,2-Dichlorethane | 0.005 | 0.007 | NA | NA | NA | 0.001 | 0.001 | 66 | 0.00 |
| K-1420 OU | Acetone | 0.019 | 0.025 | NA | NA | NA | 0.002 | 0.002 | 28.3 | 0.00 |

## Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1420 OU | Aldrin | 0.011 | NA | NA | NA | NA | 0.001 | 0.001 | 0.57 | 0.00 |
| K-1420 OU | Aluminum | 19950.00 | 49308.94 | 0.032 | 1563.09 | 937.86 | 3846.10 | 4783.95 | 2.43 | 1968.71 |
| K-1420 OU | Barium | 31.85 | 83.94 | 0.078 | 6.522 | 3.913 | 6.547 | 10.46 | 15.5 | 0.67 |
| K-1420 OU | Benzo(a)pyrene | 0.378 | 0.386 | NA | NA | NA | 0.030 | 0.030 | 1.26 | 0.02 |
| K-1420 OU | Beryllium | 0.375 | 1.290 | 1.305 | 1.684 | 1.011 | 0.101 | 1.111 | 1.87 | 0.59 |
| K-1420 OU | Bis(2-ethylhexyl) phthalate | 0.215 | 0.289 | NA | NA | NA | 0.023 | 0.023 | 23 | 0.00 |
| K-1420 OU | Chromium | 15.20 | 25.47 | 0.289 | 7.366 | 4.420 | 1.987 | 6.407 | 9.27 | 0.69 |
| K-1420 OU | Copper | 26.20 | 47.04 | NA | NA | NA | 3.669 | 3.669 | 46.8 | 0.08 |
| K-1420 OU | Fluoride | 40.02 | 0.030 | NA | NA | NA | 0.002 | 0.002 | 125.43 | 0.00 |
| K-1420 OU | Lead | 66.25 | 90.52 | NA | NA | NA | 7.060 | 7.060 | 22.6 | 0.31 |
| K-1420 OU | Lithium | 52.20 | 228.35 | NA | NA | NA | 17.81 | 17.81 | 26.6 | 0.67 |

**Table G.12 (continued)**

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1420 OU | Mercury | 0.203 | 0.430 | 5.767 | 2.481 | 1.488 | 0.034 | 1.522 | 0.09 | 16.91 |
| K-1420 OU | Methylene chloride | 0.007 | 0.009 | NA | NA | NA | 0.001 | 0.001 | 16.54 | 0.00 |
| K-1420 OU | Nitrate | 20.01 | 0.027 | NA | NA | NA | 0.002 | 0.002 | 1929 | 0.00 |
| K-1420 OU | PCB-1254 | 0.663 | 1.693 | 7.107 | 12.03 | 7.221 | 0.132 | 7.353 | 0.066 | 111.40 |
| K-1420 OU | Pentachlorophenol | 2.106 | NA | NA | NA | NA | 0.164 | 0.164 | 0.68 | 0.24 |
| K-1420 OU | Strontium | 38.250 | 255.759 | NA | NA | NA | 19.949 | 19.949 | 744 | 0.03 |
| K-1420 OU | Tetrachloroethene | 0.006 | NA | NA | NA | NA | 0.000 | 0.000 | 1.8 | 0.00 |
| K-1420 OU | Trichloroethene | 0.041 | NA | NA | NA | NA | 0.003 | 0.003 | 0.88 | 0.00 |
| K-1420 OU | Uranium | 139.11 | 282.56 | NA | NA | NA | 22.04 | 22.04 | 3.77 | 5.85 |
| K-1420 OU | Vanadium | 48.90 | 141.08 | NA | NA | NA | 11.00 | 11.00 | 0.54 | 20.38 |
| K-1420 OU | Zinc | 84.35 | 154.12 | 5.590 | 861.47 | 516.88 | 12.02 | 528.90 | 452 | 1.17 |

### Table G.12 (continued)

| Location | Analtye | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity benchmark (mg/kg/d) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE 95% UCL | | | Food | Soil | Total | | |
| K-1420 OU | Beta-BHC | 0.014 | NA | NA | NA | NA | 0.001 | 0.001 | 1.1 | 0.00 |
| K-1414 | Acetone | 0.031 | NA | NA | NA | NA | 0.002 | 0.002 | 28.3 | 0.00 |
| K-1414 | Benzo(a)pyrene | 0.287 | NA | NA | NA | NA | 0.022 | 0.022 | 1.26 | 0.02 |
| K-1414 | Bis(2-ethylhexyl) phthalate | 0.224 | NA | NA | NA | NA | 0.017 | 0.017 | 23 | 0.00 |
| K-1414 | Di-n-butlyphthalate | 0.740 | 2.382 | NA | NA | NA | 0.186 | 0.186 | 691 | 0.00 |
| K-1414 | Methylene chloride | 0.038 | 0.158 | NA | NA | NA | 0.012 | 0.012 | 16.54 | 0.00 |
| K-1414 | Tetrachloroethene | 0.004 | NA | NA | NA | NA | 0.000 | 0.000 | 1.8 | 0.00 |

NA= Not Available
PLE UCB not available - contaminant detected in only 1 sample.

* Soil to earthworm uptake factor not available, therefore, estimated earthworm concentrations and exposure from food ingestion could not be calculated.

Table G.13. Total contaminant exposure and NOAEL HQs for the American woodcock on the ORR

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BCVOU1 | 4,4-DDE | 0.108 | NA | NA | NA | NA | 0.009 | 0.009 | 0.0072 | 1.18 |
| BCVOU1 | 4,4-DDT | 0.108 | NA | NA | NA | NA | 0.009 | 0.009 | 0.0072 | 1.18 |
| BCVOU1 | Acetone | 0.036 | 0.043 | NA | NA | NA | 0.003 | 0.003 | NA | NA |
| BCVOU1 | Antimony | 1.031 | 1.737 | NA | NA | NA | 0.137 | 0.137 | NA | NA |
| BCVOU1 | Arsenic | 9.269 | 13.352 | 0.632 | 8.441 | 6.395 | 1.052 | 7.447 | 8.76 | 0.85 |
| BCVOU1 | Barium | 264.315 | 403.009 | 0.078 | 31.314 | 23.723 | 31.752 | 55.475 | 17.7 | 3.13 |
| BCVOU1 | Benzo(a)pyrene | 10.811 | 19.901 | NA | NA | NA | 1.568 | 1.568 | NA | NA |
| BCVOU1 | Beryllium | 1.051 | 1.428 | 1.305 | 1.864 | 1.412 | 0.113 | 1.525 | NA | NA |
| BCVOU1 | Bis(2-ethylhexyl) phthalate | 3.333 | 0.587 | NA | NA | NA | 0.046 | 0.046 | 1.01 | 0.05 |
| BCVOU1 | Cadmium | 5.380 | 10.736 | 4.812 | 51.661 | 39.137 | 0.846 | 39.983 | 2.6 | 15.38 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BCVOU1 | Chloroform | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BCVOU1 | Chromium (III) | 48.977 | 68.364 | 0.289 | 19.771 | 14.978 | 5.386 | 20.364 | 1.8 | 11.3 |
| BCVOU1 | Copper | 972.062 | 1779.997 | NA | NA | NA | 140.242 | 140.242 | 65 | 2.16 |
| BCVOU1 | Di-n-butylphthalate | 2.999 | 0.316 | NA | NA | NA | 0.025 | 0.025 | 0.1 | 0.25 |
| BCVOU1 | Lead | 287.462 | 543.246 | NA | NA | NA | 42.801 | 42.801 | 1.03 | 41.55 |
| BCVOU1 | Mercury | 18.982 | 31.842 | 5.767 | 183.631 | 139.115 | 2.509 | 141.623 | 0.011 | 12874.8 5 |
| BCVOU1 | Methylene chloride | 0.017 | 0.023 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| BCVOU1 | Molybdenum | 8.855 | 18.202 | NA | NA | NA | 1.434 | 1.434 | 6.8 | 0.21 |
| BCVOU1 | Nickel | 85.108 | 137.529 | NA | NA | NA | 10.836 | 10.836 | 121.8 | 0.09 |
| BCVOU1 | PCB-1254 | 1.790 | 2.665 | 7.107 | 18.936 | 14.345 | 0.210 | 14.555 | 0.31 | 46.95 |
| BCVOU1 | PCB-1260 | 3.651 | 6.741 | 7.107 | 47.903 | 36.290 | 0.531 | 36.822 | 0.31 | 118.78 |
| BCVOU1 | Selenium | 1.750 | 2.268 | NA | NA | NA | 0.179 | 0.179 | 0.9 | 0.20 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BCVOU1 | Tetrachloroethene | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BCVOU1 | Tin | 20.523 | 34.428 | NA | NA | NA | 2.713 | 2.713 | 6.2 | 0.44 |
| BCVOU1 | Toluene | 0.314 | 0.399 | NA | NA | NA | 0.031 | 0.031 | NA | NA |
| BCVOU1 | Zinc | 668.908 | 1133.306 | 5.590 | 6334.841 | 4799.1 22 | 89.291 | 4888.413 | 30.8 | 158.71 |
| LEFPC | 4,4-DDD | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.01 |
| LEFPC | 4,4-DDE | 0.015 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.02 |
| LEFPC | 4,4-DDT | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.02 |
| LEFPC | Acetone | 0.254 | 0.577 | NA | NA | NA | 0.045 | 0.045 | NA | NA |
| LEFPC | Aldrin | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| LEFPC | Antimony | 1.284 | 0.787 | NA | NA | NA | 0.062 | 0.062 | NA | NA |
| LEFPC | Barium | 121.357 | 130.047 | 0.078 | 10.105 | 7.655 | 10.246 | 17.901 | 17.7 | 1.01 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | Benzo(a)pyrene | 0.492 | 0.484 | NA | NA | NA | 0.038 | 0.038 | NA | NA |
| LEFPC | Bis(2-ethylhexyl) phthalate | 0.334 | 0.201 | NA | NA | NA | 0.016 | 0.016 | 1.01 | 0.02 |
| LEFPC | Cadmium | 4.089 | 4.645 | 4.812 | 22.349 | 16.931 | 0.366 | 17.297 | 2.6 | 6.65 |
| LEFPC | Chromium (III) | 64.608 | 65.531 | 0.289 | 18.951 | 14.357 | 5.163 | 19.520 | 1.8 | 10.84 |
| LEFPC | Copper | 78.033 | 89.671 | NA | NA | NA | 7.065 | 7.065 | 65 | 0.11 |
| LEFPC | Cyanide | 3.024 | 5.824 | NA | NA | NA | 0.459 | 0.459 | NA | NA |
| LEFPC | Di-n-butlyphthalate | 0.421 | 0.184 | NA | NA | NA | 0.015 | 0.015 | 0.1 | 0.15 |
| LEFPC | Dieldrin | 0.017 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 0.102 | 0.00 |
| LEFPC | Diethylphthalate | 0.461 | 0.173 | NA | NA | NA | 0.014 | 0.014 | NA | NA |
| LEFPC | Endosulfan I | 0.008 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 13 | 0.00 |
| LEFPC | Endosulfan II | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 13 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | Endrin | 0.017 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.54 | 0.00 |
| LEFPC | Heptachlor | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| LEFPC | Lead | 53.799 | 61.485 | NA | NA | NA | 4.844 | 4.844 | 1.03 | 4.70 |
| LEFPC | Lindane | 0.008 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 3.4 | 0.00 |
| LEFPC | Mercury | 38.488 | 41.609 | 5.767 | 239.954 | 181.78<br>3 | 3.278 | 185.061 | 0.011 | 16823.7<br>6 |
| LEFPC | Methoxychlor | 0.083 | 0.006 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| LEFPC | Methylene chloride | 0.037 | 0.053 | NA | NA | NA | 0.004 | 0.004 | NA | NA |
| LEFPC | Nickel | 34.367 | 37.906 | NA | NA | NA | 2.987 | 2.987 | 121.8 | 0.02 |
| LEFPC | PCB-1016 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | NA | NA |
| LEFPC | PCB-1242 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | 0.4 | 0.01 |
| LEFPC | PCB-1248 | 0.090 | 0.050 | NA | NA | NA | 0.004 | 0.004 | NA | NA |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| LEFPC | PCB-1254 | 0.258 | 0.224 | 7.107 | 1.591 | 1.205 | 0.018 | 1.223 | 0.31 | 3.95 |
| LEFPC | PCB-1260 | 0.431 | 0.465 | 7.107 | 3.308 | 2.506 | 0.037 | 2.543 | 0.31 | 8.20 |
| LEFPC | Pentachlorophenol | 1.692 | 0.377 | NA | NA | NA | 0.030 | 0.030 | NA | NA |
| LEFPC | Selenium | 13.566 | 8.704 | 7.416 | 64.550 | 48.901 | 0.686 | 49.587 | 0.9 | 55.10 |
| LEFPC | Thallium | 0.809 | NA | NA | NA | NA | 0.064 | 0.064 | NA | NA |
| LEFPC | Uranium | 9.708 | 11.895 | NA | NA | NA | 0.937 | 0.937 | 29 | 0.03 |
| LEFPC | Zinc | 179.913 | 166.199 | 5.590 | 929.003 | 703.79 1 | 13.094 | 716.885 | 30.8 | 23.28 |
| LEFPC | Alpha-chlordane | 0.073 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |
| LEFPC | Delta-BHC | 0.008 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 0.51 | 0.00 |
| LEFPC | Gamma-chlordane | 0.073 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |
| K-1407 OU | 1,1,1-trichlorethane | 0.015 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1407 OU | 1,2-Dichlorethene | 0.017 | 0.028 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1407 OU | Acetone | 0.028 | 0.019 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| K-1407 OU | Aluminum | 26562.963 | 28723.527 | 0.032 | 910.536 | 689.80 0 | 2263.066 | 2952.866 | 101.2 | 29.18 |
| K-1407 OU | Antimony | 7.151 | NA | NA | NA | NA | 0.563 | 0.563 | NA | NA |
| K-1407 OU | Arsenic | 12.433 | 13.068 | 0.632 | 8.262 | 6.259 | 1.030 | 7.288 | 8.76 | 0.83 |
| K-1407 OU | Barium | 110.494 | 125.275 | 0.078 | 9.734 | 7.374 | 9.870 | 17.244 | 17.7 | 0.97 |
| K-1407 OU | Beryllium | 1.016 | 1.127 | 1.305 | 1.471 | 1.114 | 0.089 | 1.203 | NA | NA |
| K-1407 OU | Boron | 6.419 | 8.400 | NA | NA | NA | 0.662 | 0.662 | 49.1 | 0.01 |
| K-1407 OU | Cadmium | 1.880 | 2.149 | 4.812 | 10.342 | 7.835 | 0.169 | 8.004 | 2.6 | 3.08 |
| K-1407 OU | Chloroform | 0.016 | 0.012 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| K-1407 OU | Chromium (III) | 61.037 | 69.864 | 0.289 | 20.205 | 15.307 | 5.504 | 20.811 | 1.8 | 11.56 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1407 OU | Copper | 40.854 | 48.640 | NA | NA | NA | 3.832 | 3.832 | 65 | 0.06 |
| K-1407 OU | Di-n-butylphthalate | 0.017 | 0.018 | NA | NA | NA | 0.001 | 0.001 | 0.1 | 0.01 |
| K-1407 OU | Lead | 30.675 | 32.996 | NA | NA | NA | 2.600 | 2.600 | 1.03 | 2.52 |
| K-1407 OU | Mercury | 4.725 | 6.396 | 5.767 | 36.888 | 27.945 | 0.504 | 28.449 | 0.011 | 2586.30 |
| K-1407 OU | Methylene chloride | 0.018 | 0.021 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1407 OU | Nickel | 192.179 | 251.090 | NA | NA | NA | 19.783 | 19.783 | 121.8 | 0.16 |
| K-1407 OU | Selenium | 7.152 | NA | 7.416 | 53.036 | 40.179 | 0.563 | 40.742 | 0.9 | 45.27 |
| K-1407 OU | Strontium | 18.142 | 20.670 | NA | NA | NA | 1.629 | 1.629 | NA | NA |
| K-1407 OU | Tetrachloroethene | 0.023 | 0.024 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1407 OU | Toluene | 0.011 | 0.001 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| K-1407 OU | Trichloroethene | 0.025 | 0.028 | NA | NA | NA | 0.002 | 0.002 | NA | NA |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1407 OU | Uranium | 143.694 | 255.850 | NA | NA | NA | 20.158 | 20.158 | 29 | 0.70 |
| K-1407 OU | Zinc | 59.778 | 64.471 | 5.590 | 360.374 | 273.011 | 5.080 | 278.090 | 30.8 | 9.03 |
| WAG 1 | 1,1,1-trichlorethane | 0.008 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | 1,1-Dichlorethene | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | 1,2-Dichlorethane | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 34.3 | 0.00 |
| WAG 1 | 1,2-Dichlorethene | 0.008 | 0.002 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | 4,4-DDD | 0.021 | NA | NA | NA | NA | 0.002 | 0.002 | 0.0072 | 0.23 |
| WAG 1 | 4,4-DDE | 0.022 | NA | NA | NA | NA | 0.002 | 0.002 | 0.0072 | 0.24 |
| WAG 1 | 4,4-DDT | 0.021 | 0.010 | NA | NA | NA | 0.001 | 0.001 | 0.0072 | 0.11 |
| WAG 1 | Acetone | 0.028 | 0.029 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| WAG 1 | Antimony | 6.127 | 6.062 | NA | NA | NA | 0.478 | 0.478 | NA | NA |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Arsenic | 9.012 | 9.769 | 0.632 | 6.176 | 4.679 | 0.770 | 5.449 | 8.76 | 0.62 |
| WAG 1 | Benzene | 0.008 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | Benzo(a)pyrene | 0.678 | 0.726 | NA | NA | NA | 0.057 | 0.057 | NA | NA |
| WAG 1 | Beryllium | 0.949 | 1.013 | 1.305 | 1.322 | 1.001 | 0.080 | 1.081 | NA | NA |
| WAG 1 | Bis(2-ethylhexyl) phthalate | 0.458 | 0.441 | NA | NA | NA | 0.035 | 0.035 | 1.01 | 0.03 |
| WAG 1 | Boron | 1204.965 | 1761.234 | NA | NA | NA | 138.764 | 138.764 | 49.1 | 2.83 |
| WAG 1 | Cadmium | 1.770 | 1.962 | 4.812 | 9.440 | 7.151 | 0.155 | 7.306 | 2.6 | 2.81 |
| WAG 1 | Carbon tetrachloride | 0.008 | 0.006 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | Chloroform | 0.010 | 0.009 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 1 | Chromium (III) | 28.951 | 32.958 | 0.289 | 9.531 | 7.221 | 2.597 | 9.817 | 1.8 | 5.45 |
| WAG 1 | Copper | 19.625 | 22.256 | NA | NA | NA | 1.754 | 1.754 | 65 | 0.03 |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Cyanide | 4.681 | NA | NA | NA | NA | 0.369 | 0.369 | NA | NA |
| WAG 1 | Di-n-butlyphthalate | 0.720 | 0.700 | NA | NA | NA | 0.055 | 0.055 | 0.1 | 0.55 |
| WAG 1 | Diethylphthalate | 0.579 | 0.048 | NA | NA | NA | 0.004 | 0.004 | NA | NA |
| WAG 1 | Endrin | 0.021 | NA | NA | NA | NA | 0.002 | 0.002 | 0.54 | 0.00 |
| WAG 1 | Heptachlor | 0.011 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 1 | Lead | 40.874 | 46.324 | NA | NA | NA | 3.650 | 3.650 | 1.03 | 3.54 |
| WAG 1 | Mercury | 1.306 | 1.850 | 5.767 | 10.667 | 8.081 | 0.146 | 8.227 | 0.011 | 747.87 |
| WAG 1 | Methylene chloride | 0.031 | 0.037 | NA | NA | NA | 0.003 | 0.003 | NA | NA |
| WAG 1 | PCB-1254 | 0.350 | 0.440 | 7.107 | 3.129 | 2.371 | 0.035 | 2.405 | 0.31 | 7.76 |
| WAG 1 | PCB-1260 | 0.247 | 0.227 | 7.107 | 1.613 | 1.222 | 0.018 | 1.240 | 0.31 | 4.00 |
| WAG 1 | Pentachlorophenol | 2.957 | 0.280 | NA | NA | NA | 0.022 | 0.022 | NA | NA |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Selenium | 14.565 | 16.841 | 7.416 | 124.890 | 94.614 | 1.327 | 95.940 | 0.9 | 106.60 |
| WAG 1 | Tetrachloroethene | 0.008 | 0.004 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | Thallium | 14.168 | 15.851 | NA | NA | NA | 1.249 | 1.249 | NA | NA |
| WAG 1 | Tin | 50.730 | 54.202 | NA | NA | NA | 4.270 | 4.270 | 6.2 | 0.69 |
| WAG 1 | Toluene | 0.007 | 0.004 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | Trichloroethene | 0.007 | 0.002 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 1 | Uranium | 7.957 | 14.470 | NA | NA | NA | 1.140 | 1.140 | 29 | 0.04 |
| WAG 1 | Vinyl chloride | 0.015 | 0.012 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 1 | Zinc | 91.993 | 105.628 | 5.590 | 590.428 | 447.294 | 8.322 | 455.616 | 30.8 | 14.79 |
| WAG 1 | Alpha-BHC | 0.012 | NA | NA | NA | NA | 0.001 | 0.001 | 0.51 | 0.00 |
| WAG 1 | Alpha-chlordane | 0.105 | NA | NA | NA | NA | 0.008 | 0.008 | 1.47 | 0.01 |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 1 | Gamma-chlordane | 0.104 | NA | NA | NA | NA | 0.008 | 0.008 | 1.47 | 0.01 |
| WAG 6 | 1,2-Dichlorethene | 0.007 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 6 | 1,4-Dioxane | 6.675 | 7.559 | NA | NA | NA | 0.596 | 0.596 | NA | NA |
| WAG 6 | Acetone | 0.014 | 0.015 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 6 | Barium | 132.813 | 143.471 | 0.078 | 11.148 | 8.445 | 11.304 | 19.749 | 17.7 | 1.12 |
| WAG 6 | Beryllium | 1.383 | 1.486 | 1.305 | 1.939 | 1.469 | 0.117 | 1.586 | NA | NA |
| WAG 6 | Bis(2-ethlhexyl) phthalate | 0.398 | 0.462 | NA | NA | NA | 0.036 | 0.036 | 1.01 | 0.04 |
| WAG 6 | Cadmium | 2.501 | 2.846 | 4.812 | 13.692 | 10.373 | 0.224 | 10.597 | 2.6 | 4.08 |
| WAG 6 | Chloroform | 0.011 | 0.013 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| WAG 6 | Cyanide | 23.817 | NA | NA | NA | NA | 1.877 | 1.877 | NA | NA |
| WAG 6 | Methylene chloride | 0.028 | 0.038 | NA | NA | NA | 0.003 | 0.003 | NA | NA |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| WAG 6 | Nickel | 38.284 | 41.626 | NA | NA | NA | 3.280 | 3.280 | 121.8 | 0.03 |
| WAG 6 | Tetrachloroethene | 0.006 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 6 | Tin | 55.025 | 89.243 | NA | NA | NA | 7.031 | 7.031 | 6.2 | 1.13 |
| WAG 6 | Toluene | 0.004 | 0.002 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 6 | Trichloroethene | 0.005 | 0.004 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| WAG 6 | Uranium | 0.818 | 1.007 | NA | NA | NA | 0.079 | 0.079 | 29 | 0.00 |
| UEFPC OU 2 | Aluminum | 29900.000 | 65257.008 | 0.032 | 2068.647 | 1567.1 57 | 5141.461 | 6708.618 | 101.2 | 66.29 |
| UEFPC OU 2 | Barium | 149.850 | 567.505 | 0.078 | 44.095 | 33.405 | 44.712 | 78.118 | 17.7 | 4.41 |
| UEFPC OU 2 | Beryllium | 1.250 | 2.197 | 1.305 | 2.868 | 2.172 | 0.173 | 2.346 | NA | NA |
| UEFPC OU 2 | Chromium (III) | 39.700 | 76.951 | 0.289 | 22.254 | 16.859 | 6.063 | 22.922 | 1.8 | 12.73 |
| UEFPC OU 2 | Copper | 22.100 | 54.932 | NA | NA | NA | 4.328 | 4.328 | 65 | 0.07 |

### Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| UEFPC OU 2 | Lead | 36.600 | 250.005 | NA | NA | NA | 19.697 | 19.697 | 1.03 | 19.12 |
| UEFPC OU 2 | Lithium | 22.700 | 31.539 | NA | NA | NA | 2.485 | 2.485 | NA | NA |
| UEFPC OU 2 | Manganese | 484.000 | 2592.793 | NA | NA | NA | 204.281 | 204.281 | 700 | 0.29 |
| UEFPC OU 2 | Nickel | 36.200 | 57.035 | NA | NA | NA | 4.494 | 4.494 | 121.8 | 0.04 |
| UEFPC OU 2 | Nitrate | 0.585 | 1.122 | NA | NA | NA | 0.088 | 0.088 | NA | NA |
| UEFPC OU 2 | Strontium | 21.100 | 117.700 | NA | NA | NA | 9.273 | 9.273 | NA | NA |
| UEFPC OU 2 | Uranium | 1.565 | 6.206 | NA | NA | NA | 0.489 | 0.489 | 29 | 0.02 |
| UEFPC OU 2 | Zinc | 86.200 | 286.977 | 5.590 | 1604.117 | 1215.2 40 | 22.610 | 1237.850 | 30.8 | 40.19 |
| BC OU 2 | 1,1,1-trichlorethane | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | 1,1-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | 1,2-Dichlorethane | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | 34.3 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | 1,2-Dichlorethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | 4,4-DDD | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.06 |
| BC OU 2 | 4,4-DDE | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.06 |
| BC OU 2 | 4,4-DDT | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.06 |
| BC OU 2 | Acetone | 0.051 | 0.105 | NA | NA | NA | 0.008 | 0.008 | NA | NA |
| BC OU 2 | Aldrin | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| BC OU 2 | Aluminum | 26143.846 | 35920.340 | 0.032 | 1138.675 | 862.63<br>2 | 2830.087 | 3692.720 | 101.2 | 36.49 |
| BC OU 2 | Antimony | 0.309 | 0.357 | NA | NA | NA | 0.028 | 0.028 | NA | NA |
| BC OU 2 | Arsenic | 33.369 | 35.093 | 0.632 | 22.186 | 16.807 | 2.765 | 19.572 | 8.76 | 2.23 |
| BC OU 2 | Barium | 101.400 | 153.978 | 0.078 | 11.964 | 9.064 | 12.132 | 21.195 | 17.7 | 1.20 |
| BC OU 2 | Benzene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Benzo(a)pyrene | 0.499 | 0.529 | NA | NA | NA | 0.042 | 0.042 | NA | NA |
| BC OU 2 | Beryllium | 1.025 | 1.315 | 1.305 | 1.717 | 1.301 | 0.104 | 1.404 | NA | NA |
| BC OU 2 | Bis(2-ethylhexyl) phthalate | 0.499 | .529 | NA | NA | NA | 0.042 | 0.042 | 1.01 | 0.04 |
| BC OU 2 | Boron | 65.500 | 79.406 | NA | NA | NA | 6.256 | 6.256 | 49.1 | 0.13 |
| BC OU 2 | Cadmium | 1.247 | 0.857 | 4.812 | 4.124 | 3.125 | 0.068 | 3.192 | 2.6 | 1.23 |
| BC OU 2 | Carbon tetrachloride | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Chloroform | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Chromium (III) | 37.331 | 44.232 | 0.289 | 12.792 | 9.691 | 3.485 | 13.176 | 1.8 | 7.32 |
| BC OU 2 | Copper | 39.223 | 57.365 | NA | NA | NA | 4.520 | 4.520 | 65 | 0.07 |
| BC OU 2 | Di-n-butlyphthalate | 0.499 | 0.529 | NA | NA | NA | 0.042 | 0.042 | 0.1 | 0.42 |
| BC OU 2 | Dieldrin | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.102 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Diethylphthalate | 0.499 | 0.529 | NA | NA | NA | 0.042 | 0.042 | NA | NA |
| BC OU 2 | Endosulfan I | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 13 | 0.00 |
| BC OU 2 | Endosulfan II | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 13 | 0.00 |
| BC OU 2 | Endrin | 0.005 | 0.006 | NA | NA | NA | 0.000 | 0.000 | 0.54 | 0.00 |
| BC OU 2 | Heptachlor | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| BC OU 2 | Lead | 81.015 | 126.822 | NA | NA | NA | 9.992 | 9.992 | 1.03 | 9.70 |
| BC OU 2 | Lindane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 3.4 | 0.00 |
| BC OU 2 | Lithium | 39.250 | 47.194 | NA | NA | NA | 3.718 | 3.718 | NA | NA |
| BC OU 2 | Manganese | 1021.523 | 1779.367 | NA | NA | NA | 140.193 | 140.193 | 700 | 0.20 |
| BC OU 2 | Mercury | 49.019 | 76.055 | 5.767 | 438.604 | 332.27<br>6 | 5.992 | 338.268 | 0.011 | 30751.6<br>2 |
| BC OU 2 | Methoxychlor | 0.026 | 0.028 | NA | NA | NA | 0.002 | 0.002 | NA | NA |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Methylene chloride | 0.016 | 0.018 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Nickel | 32.600 | 50.322 | NA | NA | NA | 3.965 | 3.965 | 121.8 | 0.03 |
| BC OU 2 | Niobium | 9.850 | NA | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| BC OU 2 | PCB-1016 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | NA | NA |
| BC OU 2 | PCB-1242 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | 0.4 | 0.01 |
| BC OU 2 | PCB-1248 | 0.052 | 0.056 | NA | NA | NA | 0.004 | 0.004 | NA | NA |
| BC OU 2 | PCB-1254 | 0.052 | 0.056 | 7.107 | 0.401 | 0.304 | 0.004 | 0.308 | 0.31 | 0.99 |
| BC OU 2 | PCB-1260 | 0.042 | 0.048 | 7.107 | 0.338 | 0.256 | 0.004 | 0.260 | 0.31 | 0.84 |
| BC OU 2 | Pentachlorophenol | 1.211 | 1.296 | NA | NA | NA | 0.102 | 0.102 | NA | NA |
| BC OU 2 | Selenium | 1.094 | 1.788 | 7.416 | 13.260 | 10.046 | 0.141 | 10.186 | 0.9 | 11.32 |
| BC OU 2 | Strontium | 109.925 | 133.870 | NA | NA | NA | 10.547 | 10.547 | NA | NA |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Tetrachloroethene | 0.007 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Toluene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Toxaphene | 0.261 | 0.284 | NA | NA | NA | 0.022 | 0.022 | NA | NA |
| BC OU 2 | Trichloroethene | 0.008 | 0.008 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Uranium | 2.041 | 2.517 | NA | NA | NA | 0.198 | 0.198 | 29 | 0.01 |
| BC OU 2 | Vanadium | 54.838 | 62.578 | NA | NA | NA | 4.930 | 4.930 | 20.5 | 0.24 |
| BC OU 2 | Vinyl chloride | 0.015 | 0.016 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| BC OU 2 | Zinc | 113.208 | 149.418 | 5.590 | 835.202 | 632.729 | 11.772 | 644.501 | 30.8 | 20.93 |
| BC OU 2 | Zirconium | 59.250 | 74.483 | NA | NA | NA | 5.868 | 5.868 | NA | NA |
| BC OU 2 | Alpha-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 0.51 | 0.00 |
| BC OU 2 | Alpha-chlordane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| BC OU 2 | Beta-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| BC OU 2 | Delta-BHC | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 0.51 | 0.00 |
| BC OU 2 | Gamma-chlordane | 0.003 | 0.003 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |
| SCF | 1,1,1-trichlorethane | 0.436 | 0.955 | NA | NA | NA | 0.075 | 0.075 | NA | NA |
| SCF | 1,1-Dichlorethene | 10.464 | 19.679 | NA | NA | NA | 1.550 | 1.550 | NA | NA |
| SCF | 1,2-Dichlorethane | 60.893 | 157.216 | NA | NA | NA | 12.387 | 12.387 | 34.3 | 0.36 |
| SCF | 4,4-DDD | 0.005 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.02 |
| SCF | 4,4-DDE | 0.003 | 0.002 | NA | NA | NA | 0.000 | 0.000 | 0.0072 | 0.02 |
| SCF | 4,4-DDT | 0.006 | 0.006 | NA | NA | NA | 0.001 | 0.001 | 0.0072 | 0.07 |
| SCF | Acetone | 97.955 | 212.986 | NA | NA | NA | 16.781 | 16.781 | NA | NA |
| SCF | Aldrin | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| SCF | Aluminum | 16294.045 | 20546.940 | 0.032 | 651.338 | 493.43 8 | 1618.85 | 2112.288 | 101.2 | 20.87 |
| SCF | Antimony | 3.125 | 1.215 | NA | NA | NA | 0.096 | 0.096 | 101.2 | 0.00 |
| SCF | Arsenic | 12.771 | 14.534 | 0.632 | 9.189 | 6.961 | 1.145 | 8.106 | 8.76 | 0.93 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| SCF | Barium | 111.605 | 139.739 | 0.078 | 10.858 | 8.226 | 11.010 | 19.235 | 17.7 | 1.09 |
| SCF | Benzene | 0.916 | 2.040 | NA | NA | NA | 0.161 | 0.161 | NA | NA |
| SCF | Benzo(a)pyrene | 0.483 | 0.322 | NA | NA | NA | 0.025 | 0.025 | NA | NA |
| SCF | Beryllium | 1.480 | 1.611 | 1.305 | 2.103 | 1.593 | 0.127 | 1.720 | NA | NA |
| SCF | Bis(2-ethylhexyl) phthalate | 0.439 | 0.176 | NA | NA | NA | 0.014 | 0.014 | 1.01 | 0.01 |
| SCF | Cadmium | 6.132 | 7.413 | 4.812 | 35.670 | 27.023 | 0.584 | 27.607 | 2.6 | 10.62 |
| SCF | Carbon tetrachloride | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| SCF | Chloroform | 0.886 | 1.987 | NA | NA | NA | 0.157 | 0.157 | NA | NA |
| SCF | Chromium | 56.892 | 61.157 | 0.289 | 17.687 | 13.399 | 4.818 | 18.217 | NA | NA |
| SCF | Copper | 20.555 | 27.899 | NA | NA | NA | 2.198 | 2.198 | 65 | 0.03 |
| SCF | Di-n-butlyphthalate | 0.470 | 0.118 | NA | NA | NA | 0.009 | 0.009 | 0.1 | 0.09 |
| SCF | Dieldrin | 0.004 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.102 | 0.00 |
| SCF | Endosulfan I | 0.003 | NA | NA | NA | NA | 0.000 | 0.000 | 13 | 0.00 |
| SCF | Endrin | 0.005 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 0.54 | 0.00 |
| SCF | Heptachlor | 0.003 | NA | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| SCF | Lead | 41.506 | 52.212 | NA | NA | NA | 4.114 | 4.114 | 1.03 | 3.99 |
| SCF | Manganese | 1392.092 | 1849.264 | NA | NA | NA | 145.700 | 145.700 | 700 | 0.21 |

**Table G.13 (continued)**

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| SCF | Mercury | 0.682 | 0.854 | 5.767 | 4.926 | 3.732 | 0.067 | 3.799 | 0.011 | 345.39 |
| SCF | Methoxychlor | 0.027 | 0.014 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| SCF | Methylene chloride | 136.175 | 281.149 | NA | NA | NA | 22.151 | 22.151 | NA | NA |
| SCF | Nickel | 18.418 | 20.372 | NA | NA | NA | 1.605 | 1.605 | 121.8 | 0.01 |
| SCF | PCB-1254 | 0.057 | 0.038 | 7.107 | 0.267 | 0.202 | 0.003 | 0.205 | 0.31 | 0.66 |
| SCF | PCB-1260 | 0.066 | 0.069 | 7.107 | 0.493 | 0.374 | 0.005 | 0.379 | 0.31 | 1.22 |
| SCF | Pentachlorophenol | 0.266 | 0.005 | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| SCF | Selenium | 2.796 | 2.965 | 7.416 | 21.984 | 16.655 | 0.234 | 16.888 | 0.9 | 18.76 |
| SCF | Tetrachloroethene | 0.546 | 1.142 | NA | NA | NA | 0.090 | 0.090 | NA | NA |
| SCF | Toluene | 0.917 | 2.045 | NA | NA | NA | 0.161 | 0.161 | NA | NA |
| SCF | Trichloroethene | 0.782 | 1.493 | NA | NA | NA | 0.118 | 0.118 | NA | NA |
| SCF | Uranium | 3.128 | 3.313 | NA | NA | NA | 0.261 | 0.261 | 29 | 0.01 |
| SCF | Zinc | 114.172 | 146.031 | 5.590 | 816.269 | 618.385 | 11.505 | 629.891 | 30.8 | 20.45 |
| SCF | Alpha-chlordane | 0.003 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |
| SCF | Delta-BHC | 0.003 | 0.000 | NA | NA | NA | 0.000 | 0.000 | 0.51 | 0.00 |
| SCF | Gamma-chlordane | 0.003 | 0.001 | NA | NA | NA | 0.000 | 0.000 | 1.47 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1420 OU | 1,2-Dichlorethane | 0.005 | 0.007 | NA | NA | NA | 0.001 | 0.001 | 34.3 | 0.00 |
| K-1420 OU | Acetone | 0.019 | 0.025 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1420 OU | Aldrin | 0.011 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| K-1420 OU | Aluminum | 19950.000 | 49308.945 | 0.032 | 1563.094 | 1184.1 62 | 3884.947 | 5069.109 | 101.2 | 50.09 |
| K-1420 OU | Barium | 31.850 | 83.938 | 0.078 | 6.522 | 4.941 | 6.613 | 11.554 | 17.7 | 0.65 |
| K-1420 OU | Benzo(a)pyrene | 0.378 | 0.386 | NA | NA | NA | 0.030 | 0.030 | NA | NA |
| K-1420 OU | Beryllium | 0.375 | 1.290 | 1.305 | 1.684 | 1.276 | 0.102 | 1.378 | NA | NA |
| K-1420 OU | Bis(2-ethylhexyl) phthalate | 0.215 | 0.289 | NA | NA | NA | 0.023 | 0.023 | 1.01 | 0.02 |
| K-1420 OU | Chromium | 15.200 | 25.472 | 0.289 | 7.366 | 5.581 | 2.007 | 7.587 | NA | NA |
| K-1420 OU | Copper | 26.200 | 47.035 | NA | NA | NA | 3.706 | 3.706 | 65 | 0.06 |
| K-1420 OU | Fluoride | 40.015 | 0.030 | NA | NA | NA | 0.002 | 0.002 | 7.6 | 0.00 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1420 OU | Lead | 66.250 | 90.518 | NA | NA | NA | 7.132 | 7.132 | 1.03 | 6.92 |
| K-1420 OU | Lithium | 52.200 | 228.354 | NA | NA | NA | 17.992 | 17.992 | NA | NA |
| K-1420 OU | Mercury | 0.203 | 0.430 | 5.767 | 2.481 | 1.879 | 0.034 | 1.913 | 0.011 | 173.91 |
| K-1420 OU | Methylene chloride | 0.007 | 0.009 | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| K-1420 OU | Nitrate | 20.008 | 0.027 | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1420 OU | PCB-1254 | 0.663 | 1.693 | 7.107 | 12.034 | 9.117 | 0.133 | 9.250 | 0.31 | 29.84 |
| K-1420 OU | Pentachlorophenol | 2.106 | NA | NA | NA | NA | 0.166 | 0.166 | NA | NA |
| K-1420 OU | Strontium | 38.250 | 255.759 | NA | NA | NA | 20.151 | 20.151 | NA | NA |
| K-1420 OU | Tetrachloroethene | 0.006 | NA | NA | NA | NA | 0.000 | 0.000 | NA | NA |
| K-1420 OU | Trichloroethene | 0.041 | NA | NA | NA | NA | 0.003 | 0.003 | NA | NA |
| K-1420 OU | Uranium | 139.109 | 282.563 | NA | NA | NA | 22.263 | 22.263 | 29 | 0.77 |

## Table G.13 (continued)

| Location | Analyte | Soil concentration (mg/kg) | | Soil-earthworm uptake factor | Estimated worm concentration (mg/kg) | Exposure estimate (mg/kg/d) | | | Toxicity bench-mark (mg/kg) | NOAEL HQ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | PLE UCB | | | Food | Soil | Total | | |
| K-1420 OU | Vanadium | 48.900 | 141.081 | NA | NA | NA | 11.115 | 11.115 | 20.5 | 0.54 |
| K-1420 OU | Zinc | 84.350 | 154.117 | 5.590 | 861.468 | 652.627 | 12.143 | 664.769 | 30.8 | 21.58 |
| K-1420 OU | Beta-BHC | 0.014 | NA | NA | NA | NA | 0.001 | 0.001 | NA | NA |
| K-1414 | Acetone | 0.031 | NA | NA | NA | NA | 0.002 | 0.002 | NA | NA |
| K-1414 | Benzo(a)pyrene | 0.287 | NA | NA | NA | NA | 0.023 | 0.023 | NA | NA |
| K-1414 | Bis(2-ethylhexyl) phthalate | 0.224 | NA | NA | NA | NA | 0.018 | 0.018 | 1.01 | 0.02 |
| K-1414 | Di-n-butlyphthalate | 0.740 | 2.382 | NA | NA | NA | 0.188 | 0.188 | 0.1 | 1.88 |
| K-1414 | Methylene chloride | 0.038 | 0.158 | NA | NA | NA | 0.012 | 0.012 | NA | NA |
| K-1414 | Tetrachloroethene | 0.004 | NA | NA | NA | NA | 0.000 | 0.000 | NA | NA |

NA= Not Available
PLE UCB not available - contaminant detected in only 1 sample.

* Soil to earthworm uptake factor not available, therefore, estimated earthworm concentrations and exposure from food ingestion could not be calculated.

## Table G.14 . Estimated NOAELs and LOAELs for mammals

| | Experimental information | | | | | | Short-tailed shrew | | Eastern cottontail | | White-tailed deer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
| Acetone | NA | rat | 100 90 days | 500 90 days | liver & kidney damage | EPA 1986c | 2.26 | 141 | 6.7 | 33 | 1.9 | 9 |
| Aluminum | $AlCl_3$ | mouse | 1.93[1] 3 gen. | 19.3 3 gen. | reproduction | Ondreicka et al. 1966 | 2.43 | 24.3 | 0.57 | 5.7 | 0.16 | 1.6 |
| Antimony | Antimony Potassium Tartrate | mouse | .125[1] >1yr | 1.25 >1yr | lifespan, longevity | Schroeder et al. 1968b | 0.157 | 1.57 | 0.037 | 0.37 | 0.01 | 0.1 |
| Arsenic | As+3 | mouse | 0.126[1] 3 gen. | 1.26 3 gen. | reproduction | Schroeder and Mitchner 1971 | 0.158 | 1.58 | 0.037 | 0.370 | 0.01 | 0.1 |
| Barium | BaCl | rat | 100 16 mon. | | growth, hypertension | Perry et al. 1983 | 15.5 | | 3.6 | | 1 | |
| | | | | 19.8[2] 10 days | mortality | Borzelleca et al. 1988 | | 56 | | 13.2 | | 3.7 |
| Benzo(a)pyrene | NA | mouse | 1[1] critical lifestage[3] | 10 critical lifestage[3] | reproduction | Mackenzie and Angevine 1981 | 1.26 | 12.6 | | | | |
| Boron | Boric acid | rat | 28 3 gen. | 93.6 3 gen. | reproduction | Weir and Fisher 1972 | 79.2 | 265 | 18.6 | 62 | | |
| Cadmium | $CdCl_2$ | rat | .008 4 gen. | .01 4 gen. | reproduction | Wills et al. 1981 | 0.023 | 0.028 | 0.005 | 0.007 | 0.001 | 0.002 |
| Chromium | $Cr^{+3}$ | rat | | | reproduction, longevity | Ivankovic & Preussmann 1975 | 9.27 | 37.2 | | | | |
| Chloroform | | | | | | | | | 59 | 189 | | |
| Copper | copper sulfate | mink | 11.71 357 days | 15.14 357 days | reproduction | Aulerich et al. 1982 | 46.8 | 60.5 | 11 | 14.3 | 3.1 | 4 |

## Table G.14 (continued)

| | Experimental information | | | | | | Short-tailed shrew | | Eastern cottontail | | White-tailed deer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
| 1,2-Dichlorothane | NA | mouse | 50<br>2 gen. | - | reproduction | Lane et al. 1982 | | | 16 | - | 4 | - |
| Lead | acetate | rat | 8<br>3 gen. | 80<br>3 gen. | reproduction | Azar et al. 1973 | 22.6 | 226 | 5.3 | 53 | | |
| Manganese | oxide | rat | 88<br>gestation | 284<br>gestation | reproduction | Laskey et al. 1992 | | | 59 | 189 | 16 | 53 |
| Mercury | methyl | rat | 0.032<br>3 gen. | 0.16<br>3 gen. | reproduction | Verschuuren et al. 1976 | 0.09 | 0.45 | 0.021 | 0.11 | 0.006 | 0.03 |
| Methylene Chloride | NA | rat | 5.85<br>2 yrs. | 50<br>2 yrs. | liver histology | NCA 1982 | 16.54 | 141 | 3.9 | 33 | 1.09 | 9 |
| Molybdenum | molybdate | mouse | 0.26<br>3 gen. | 2.6<br>3 gen. | reproduction | Schroeder and Mitchner 1971 | 0.33 | 3.3 | 0.08 | 0.8 | | |
| Niobium | sodium niobate | mouse | 0.155<br>> 1 yr. | 1.55<br>> 1 yr. | lifespan longevity | Schroeder et al. 1968 | 0.195 | 1.95 | 0.046 | 0.46 | | |
| PCBs | Aroclor 1254 | Oldfield mouse | .068[1]<br>12 mo. | 0.68<br>12 mo. | reproduction | McCoy et al. 1995 | 0.066 | 0.66 | 0.016 | 0.16 | 0.004 | 0.04 |
| Selenium | selenate | mouse | 0.076[1]<br>3 gen. | 0.76<br>3 gen. | reproduction | Schroeder and Mitchner 1971 | 0.096 | 0.96 | 0.023 | 0.22 | 0.006 | 0.06 |
| Thallium | sulfate | rat | 0.0074[1]<br>60 days | 0.074<br>60 days | reproduction | Formigli et al. 1986 | 0.021 | 0.212 | 0.005 | 0.05 | 0.001 | 0.014 |
| Trichloroethene | NA | mouse | 0.7[1]<br>6 wks. | 7<br>6 wks. | hepatotoxicity | Buben and O'Flaherty 1985 | | | | | 0.06 | 0.6 |
| Uranium | acetate | mouse | 3.07<br>critical lifestage[4] | 6.13 | reproduction | Paternain et al. 1989 | 3.77 | 7.5 | 0.89 | 1.8 | | |

**Table G.14 (continued)**

| | Experimental information | | | | | | Short-tailed shrew | | Eastern cottontail | | White-tailed deer | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
| Vanadium | sodium metavanadate | rat | 0.21[1] critical lifestage[4] | 2.1 | reproduction | Domingo et al. 1986 | 0.54 | 5.4 | 0.13 | 1.3 | 0.04 | 0.4 |
| Zinc | oxide | rat | 160 critical lifestage[5] | 320 | reproduction | Schlicker and Cox 1968 | 452 | 905 | | | | |
| Zirconium | sulfate | mouse | 1.74 > 1 yr. | - | lifespan, longevity | Schroeder et al. 1968b | 2.19 | - | 0.52 | - | | |

[1] Estimated NOAEL: LOAEL to NOAEL factor applied.
[2] Subchronic to chronic uncertainty factor of 0.1 applied.
[3] Critical lifestage: days 7 to 16 of gestation.
[4] Critical lifestage: 60 days prior to gestation, through gestation, delivery and lactation.
[5] Critical lifestage: days 1 to 16 of gestation.

**Table G.15. Estimated NOAELs and LOAELs for the Avian endpoints**

| | Experimental information | | | | | | American woodcock | | Wild turkey | |
|---|---|---|---|---|---|---|---|---|---|---|
| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
| Aluminum | $Al_2(SO_4)_3$ | ringed dove | 109.7 4 mon. | | reproduction | Carriere et al. 1986 | 101.2 | | 33.2 | |
| | chloride | white leghorn chicks | | 44.5 2 wks. | mortality | Storer and Nelson 1968 | | 33 | | 10.8 |
| Barium | hydroxide | 1-day chicks | 20.8 4 wks. | 41.7 4 wks | mortality | Johnson et al. 1960 | 17.7 | 35.4 | | |
| Boron | boric acid | mallard ducks | 28.8 critical lifestage[2] | 100 | reproduction | Smith and Anders 1989 | 49.1 | 171 | | |
| Cadmium | chloride | mallard ducks | 1.45 90 days | 20 90 days | reproduction | White and Finley 1978 | 2.6 | 36 | | |
| Copper | oxide | 1 day chicks | 46.97 10 wks | 61.72 10 wks | growth, mortality | Mehring et al. 1960 | 65 | 85.6 | 21 | 28.1 |
| 4,4-DDT | NA | brown pelican | 0.0028[1] 5 yrs | 0.028 5 yrs | reproduction | Anderson et al. 1975 | 0.0072 | 0.072 | | |
| 1,2-Dichlorothane | NA | chicken | 17.2 2 yrs. | 34.4 2 yrs. | reproduction | Alumot et al. 1976 | | | 11.2 | 22 |
| Di-n-butyl phthalate | NA | ringed dove | 0.11[1] 4 wks | 1.1 4 wks | reproduction | Peakall 1974 | 0.1 | 1 | | |
| Lead | acetate | japanese quail | 1.13[1] 12 wks. | 11.3 12 wks. | reproduction | Edens et al. 1976 | 1.03 | 10 | .34 | 3 |
| Mercury | methyl Hg Dicyandiamide | mallard duck | 0.0064 3 gen. | 0.064 3 gen. | reproduction | Heinz 1979 | 0.011 | 0.109 | 0.004 | 0.036 |
| PCB-1254 | NA | ring-necked pheasant | 0.18[1] 17 wks | 1.8 17 wks | reproduction | Dahlgren et al. 1972 | 0.31 | 3.07 | | |

## Table G.15 (continued)

| | | Experimental information | | | | | American woodcock | | Wild turkey | |
|---|---|---|---|---|---|---|---|---|---|---|
| Contaminant | Form | Test species | NOAEL (mg/kg/d) and duration | LOAEL (mg/kg/d) and duration | Endpoint | Citation | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) | Estimated NOAEL (mg/kg/d) | Estimated LOAEL (mg/kg/d) |
| Selenium | selanomethionine | mallard duck | 0.4<br>100 days | 0.8<br>100 days | reproduction | Heinz et al. 1989 | 0.9 | 1.7 | | |
| Tin | bis(Tributyltin) oxide | japanese quail | 6.8<br>6 wks | 16.9<br>6 wks | reproduction | Schlatterer et al. 1993 | 6.2 | 15.4 | | |
| Zinc | sulfate | white leghorn hens | 1.935<br>44 wks. | 1.766<br>44 wks. | reproduction | Stahl et al. 1990 | 30.8 | 278 | 10.1 | 91 |

[1] Estimated NOAEL: LOAEL to NOAEL factor applied.
[2] Critical lifestage: 3 wks prior to, during, and 3 wks post reproduction.

Table G.16. HQs for contaminants of potential concern for white-tailed deer on the ORR

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BCVOU1 | Barium | 2.1099 | 1 | 2.11 | 3.7 | 0.57 |
| BCVOU1 | Cadmium | 0.2199 | 0.001 | 219.88 | 0.002 | 109.94 |
| BCVOU1 | Copper | 23.0234 | 3.1 | 7.43 | 4 | 5.76 |
| BCVOU1 | Mercury | 0.1598 | 0.006 | 26.64 | 0.03 | 5.33 |
| BCVOU1 | PCB-1260 * | 0.0048 | 0.004 | 1.19 | 0.04 | 0.12 |
| LEFPC | Cadmium | 0.0951 | 0.001 | 95.12 | 0.002 | 47.56 |
| LEFPC | Mercury | 0.2089 | 0.006 | 34.81 | 0.03 | 6.96 |
| LEFPC | Selenium | 0.0142 | 0.006 | 2.37 | 0.06 | 0.24 |
| K-1407 OU | Aluminum | 21.2300 | 0.16 | 132.69 | 1.6 | 13.27 |
| K-1407 OU | Antimony | 0.0132 | 0.01 | 1.32 | 0.1 | 0.13 |
| K-1407 OU | Cadmium | 0.0440 | 0.001 | 44.02 | 0.002 | 22.01 |
| K-1407 OU | Mercury | 0.0321 | 0.006 | 5.35 | 0.03 | 1.07 |

**Table G.16 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| K-1407 OU | Selenium | 0.0117 | 0.006 | 1.95 | 0.06 | 0.19 |
| WAG 1 | Antimony | 0.0112 | 0.01 | 1.12 | 0.1 | 0.11 |
| WAG 1 | Cadmium | 0.0402 | 0.001 | 40.18 | 0.002 | 20.09 |
| WAG 1 | Mercury | 0.0093 | 0.006 | 1.55 | 0.03 | 0.31 |
| WAG 1 | Selenium | 0.0275 | 0.006 | 4.58 | 0.06 | 0.46 |
| WAG 1 | Thallium | 0.0098 | 0.001 | 9.76 | 0.014 | 0.70 |
| WAG 6 | Cadmium | 0.0583 | 0.001 | 58.28 | 0.002 | 29.14 |
| UEFPC OU 2 | Aluminum | 48.2324 | 0.16 | 301.45 | 1.6 | 30.15 |
| UEFPC OU 2 | Barium | 2.9711 | 1 | 2.97 | 3.7 | 0.80 |
| UEFPC OU 2 | Manganese | 21.5592 | 16 | 1.35 | 53 | 0.41 |
| BC OU 2 | Aluminum | 26.5493 | 0.16 | 165.93 | 1.6 | 16.59 |
| BC OU 2 | Arsenic | 0.0259 | 0.01 | 2.59 | 0.1 | 0.26 |
| BC OU 2 | Cadmium | 0.0176 | 0.001 | 17.55 | 0.002 | 8.78 |
| BC OU 2 | Mercury | 0.3818 | 0.006 | 63.63 | 0.03 | 12.73 |

**Table G.16 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BC OU 2 | Vanadium | 0.0501 | 0.04 | 1.25 | 0.4 | 0.13 |
| SCF | 1,2-Dichlorethane | 25.5651 | 4 | 6.39 | NA | NA |
| SCF | Acetone | 349.7176 | 1.9 | 184.06 | 9 | 38.86 |
| SCF | Aluminum | 15.1866 | 0.16 | 94.92 | 1.6 | 9.49 |
| SCF | Arsenic | 0.0107 | 0.01 | 1.07 | 0.1 | 0.11 |
| SCF | Cadmium | 0.1518 | 0.001 | 151.82 | 0.002 | 75.91 |
| SCF | Methylene chloride | 59.6044 | 1.09 | 54.68 | 9 | 6.62 |
| SCF | Trichloroethene | 0.0739 | 0.06 | 1.23 | 0.6 | 0.12 |
| K-1420 OU | Aluminum | 36.4450 | 0.16 | 227.78 | 1.6 | 22.78 |
| K-1420 OU | Vanadium | 0.1130 | 0.04 | 2.82 | 0.4 | 0.28 |
| CR OU2[a] | Arsenic | 0.12841 | 0.01 | 12.841 | 0.1 | 1.28 |
| CR OU2 | Cadmium | 0.03567 | 0.001 | 35.67 | 0.002 | 17.84 |
| CR OU2 | Selenium | 0.69332 | 0.006 | 115.55333 | 0.06 | 11.56 |
| CR OU2 | Thallium | 0.03029 | 0.001 | 30.29 | 0.014 | 2.16 |
| CR OU2 | Vanadium | 0.05056 | 0.04 | 1.264 | 0.4 | 0.13 |

Table G.16 (continued)

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| WAG 5 | Mercury | 0.0065 | 0.006 | 1.09 | 0.03 | 0.22 |
| WAG 5 | Selenium | 0.0157 | 0.006 | 2.62 | 0.06 | 0.26 |

* The NOAEL and LOAEL Toxicity Benchmark for PCB-1254 is used.

[a] CR OU2 Source: Ecological Risk Assessment for the Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond/Upper McCoy Branch) at the Oak Ridge Y-12 Pant, Oak Ridge . DOE/OR/02-1238 DO

**Table G.17. HQs for contaminants of concern for wild turkey on the ORR**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BCVOU1 | Copper | 26.3317 | 21 | 1.25 | 28.1 | 0.94 |
| BCVOU1 | Lead | 2.2507 | 0.34 | 6.62 | 3 | 0.75 |
| BCVOU1 | Mercury | 0.2255 | 0.004 | 56.39 | 0.036 | 6.27 |
| BCVOU1 | Zinc | 15.7485 | 10.1 | 1.56 | 91 | 0.17 |
| LEFPC | Mercury | 0.2947 | 0.004 | 73.68 | 0.036 | 8.19 |
| K-1407 OU | Aluminum | 83.6746 | 33.2 | 2.52 | 10.8 | 7.75 |
| K-1407 OU | Mercury | 0.0453 | 0.004 | 11.33 | 0.036 | 1.26 |
| WAG 1 | Mercury | 0.0131 | 0.004 | 3.28 | 0.036 | 0.36 |

**Table G.17 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| UEFPC OU 2 | Aluminum | 190.1004 | 33.2 | 5.73 | 10.8 | 17.60 |
| UEFPC OU 2 | Lead | 1.0358 | 0.34 | 3.05 | 3 | 0.35 |
| BC OU 2 | Aluminum | 104.6397 | 33.2 | 3.15 | 10.8 | 9.69 |
| BC OU 2 | Lead | 0.5254 | 0.34 | 1.55 | 3 | 0.18 |
| BC OU 2 | Mercury | 0.5387 | 0.004 | 134.68 | 0.036 | 14.96 |
| SCF | 1,2-Dichlorethane | 25.2488 | 11.2 | 2.25 | 22 | 1.15 |
| SCF | Aluminum | 59.8554 | 33.2 | 1.80 | 10.8 | 5.54 |
| SCF | Mercury | 0.0061 | 0.004 | 1.51 | 0.036 | 0.17 |
| K-1420 OU | Aluminum | 143.6421 | 33.2 | 4.33 | 10.8 | 13.30 |
| K-1420 OU | Lead | 0.3750 | 0.34 | 1.10 | 3 | 0.13 |

**Table G.17 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| WAG 5 | Lead | 0.3895 | 0.34 | 1.15 | 3 | 0.13 |
| WAG 5 | Mercury | 0.0092 | 0.004 | 2.30 | 0.036 | 0.26 |
| WAG 5 | Zinc | 13.8971 | 10.1 | 1.38 | 91 | 0.15 |

Table G.18. HQs for contaminants of potential concern for the short-tailed shrews on the ORR

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BCVOU1 | Arsenic | 6.11 | 0.158 | 38.6 | 1.58 | 3.9 |
| BCVOU1 | Barium | 50.22 | 15.5 | 3.2 | 56 | 0.9 |
| BCVOU1 | Benzo(a)pyrene | 1.55 | 1.26 | 1.2 | 12.6 | 0.1 |
| BCVOU1 | Cadmium | 31.83 | 0.023 | 1384.1 | 0.028 | 1136.9 |
| BCVOU1 | Chromium | 17.19 | 9.27 | 1.9 | 37.2 | 0.5 |
| BCVOU1 | Copper | 138.84 | 46.8 | 3.0 | 60.5 | 2.3 |
| BCVOU1 | Lead | 42.37 | 22.6 | 1.9 | 226 | 0.2 |
| BCVOU1 | Mercury | 112.66 | 0.09 | 1251.8 | 0.45 | 250.4 |
| BCVOU1 | Molybdenum | 1.42 | 0.33 | 4.3 | 3.3 | 0.4 |
| BCVOU1 | PCB-1254 | 11.57 | 0.066 | 175.3 | 0.66 | 17.5 |
| BCVOU1 | PCB-1260 | 29.27 | 0.066 | 443.5 | 0.66 | 44.3 |
| BCVOU1 | Selenium | 0.177 | 0.096 | 1.8 | 0.96 | 0.2 |
| BCVOU1 | Zinc | 3889.30 | 452 | 8.6 | 905 | 4.3 |
| LEFPC | Barium | 16.21 | 15.5 | 1.0 | 56 | 0.3 |
| LEFPC | Cadmium | 13.77 | 0.023 | 598.8 | 0.028 | 491.8 |
| LEFPC | Chromium | 16.48 | 9.27 | 1.8 | 37.2 | 0.4 |
| LEFPC | Mercury | 147.22 | 0.09 | 1635.8 | 0.45 | 327.2 |

**Table G.18 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| LEFPC | PCB-1254 | 0.972 | 0.066 | 14.7 | 0.66 | 1.5 |
| LEFPC | PCB-1260 | 2.02 | 0.066 | 30.6 | 0.66 | 3.1 |
| LEFPC | Selenium | 39.41 | 0.096 | 410.5 | 0.96 | 41.1 |
| LEFPC | Thallium | 0.063 | 0.021 | 3.0 | 0.212 | 0.3 |
| LEFPC | Zinc | 570.37 | 452 | 1.3 | 905 | 0.6 |
| K-1407 OU | Aluminum | 2786.76 | 2.43 | 1146.8 | 24.3 | 114.7 |
| K-1407 OU | Antimony | 0.558 | 0.157 | 3.6 | 1.57 | 0.4 |
| K-1407 OU | Arsenic | 5.98 | 0.158 | 37.8 | 1.58 | 3.8 |
| K-1407 OU | Barium | 15.61 | 15.5 | 1.0 | 56 | 0.3 |
| K-1407 OU | Cadmium | 6.37 | 0.023 | 277.1 | 0.028 | 0.3 |
| K-1407 OU | Chromium | 17.57 | 9.27 | 1.9 | 37.2 | 0.5 |
| K-1407 OU | Mercury | 22.63 | 0.09 | 251.5 | 0.45 | 50.3 |
| K-1407 OU | Selenium | 32.38 | 0.096 | 337.3 | 0.96 | 33.7 |
| K-1407 OU | Uranium | 19.96 | 3.77 | 5.3 | 7.5 | 2.7 |
| WAG 1 | Antimony | 0.473 | 0.157 | 3.0 | 1.57 | 0.3 |
| WAG 1 | Arsenic | 4.47 | 0.158 | 28.3 | 1.58 | 2.8 |
| WAG 1 | Boron | 137.38 | 79.2 | 1.7 | 265 | 0.5 |

Table G.18 (continued)

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| WAG 1 | Cadmium | 5.82 | 0.023 | 252.9 | 0.028 | 207.7 |
| WAG 1 | Mercury | 6.54 | 0.09 | 72.7 | 0.45 | 14.5 |
| WAG 1 | PCB-1254 | 1.91 | 0.066 | 29.0 | 0.66 | 2.9 |
| WAG 1 | PCB-1260 | 0.986 | 0.066 | 14.9 | 0.66 | 1.5 |
| WAG 1 | Selenium | 76.25 | 0.096 | 794.2 | 0.96 | 79.4 |
| WAG 1 | Thallium | 1.24 | 0.021 | 58.9 | 0.212 | 5.8 |
| | | | | | | |
| WAG 6 | Barium | 17.88 | 15.5 | 1.2 | 56 | 0.3 |
| WAG 6 | Cadmium | 8.44 | 0.023 | 366.8 | 0.028 | 301.3 |
| | | | | | | |
| UEFPC OU 2 | Aluminum | 6331.23 | 2.43 | 2605.4 | 24.3 | 260.5 |
| UEFPC OU 2 | Barium | 70.72 | 15.5 | 4.6 | 56 | 1.3 |
| UEFPC OU 2 | Beryllium | 1.892 | 1.87 | 1.01 | NA | NA |
| UEFPC OU 2 | Chromium | 19.35 | 9.27 | 2.1 | 37.2 | 0.5 |
| UEFPC OU 2 | Zinc | 984.85 | 452 | 2.2 | 905 | 1.1 |
| | | | | | | |
| BC OU 2 | Aluminum | 3484.99 | 2.43 | 1434.2 | 24.3 | 143.4 |
| BC OU 2 | Arsenic | 16.05 | 0.158 | 101.6 | 1.58 | 10.2 |
| BC OU 2 | Barium | 19.19 | 15.5 | 1.2 | 56 | 0.3 |

## Table G.18 (continued)

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BC OU 2 | Cadmium | 2.54 | 0.023 | 110.5 | 0.028 | 90.8 |
| BC OU 2 | Chromium | 11.13 | 9.27 | 1.2 | 37.2 | 0.3 |
| BC OU 2 | Mercury | 269.09 | 0.09 | 2989.9 | 0.45 | 598.0 |
| BC OU 2 | Niobium | 0.7683 | 0.195 | 3.9 | 1.95 | 0.4 |
| BC OU 2 | PCB-1254 | 0.245 | 0.066 | 3.7 | 0.66 | 0.4 |
| BC OU 2 | PCB-1260 | 0.206 | 0.066 | 3.1 | 0.66 | 0.3 |
| BC OU 2 | Selenium | 8.10 | 0.096 | 84.3 | 0.96 | 8.4 |
| BC OU 2 | Vanadium | 4.88 | 0.54 | 9.0 | 5.4 | 0.9 |
| BC OU 2 | Zirconium | 5.81 | 2.19 | 2.7 | NA | NA |
| SCF | Acetone | 16.61 | 2.26 | 7.4 | 141 | 0.1 |
| SCF | Aluminum | 1993.46 | 0.57 | 3497.3 | 24.3 | 82.0 |
| SCF | Arsenic | 6.65 | 0.158 | 42.1 | 1.58 | 4.2 |
| SCF | Barium | 17.41 | 15.5 | 1.1 | 56 | 0.3 |
| SCF | Cadmium | 21.98 | 0.023 | 955.7 | 0.028 | 785.0 |
| SCF | Chromium | 15.38 | 9.27 | 1.7 | 37.2 | 0.4 |
| SCF | Mercury | 3.02 | 0.09 | 33.6 | 0.45 | 6.7 |
| SCF | Methylene chloride | 21.93 | 16.54 | 1.3 | 141 | 0.2 |

**Table G.18 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| SCF | PCB-1254 | 0.163 | 0.066 | 2.5 | 0.66 | 0.2 |
| SCF | PCB-1260 | 0.301 | 0.066 | 4.6 | 0.66 | 0.5 |
| SCF | Selenium | 13.42 | 0.096 | 139.8 | 0.96 | 14.0 |
| SCF | Zinc | 501.15 | 452 | 1.1 | 905 | 0.6 |
| | | | | | | |
| K-1420 OU | Aluminum | 4783.95 | 2.43 | 1968.7 | 24.3 | 196.9 |
| K-1420 OU | Mercury | 1.52 | 0.09 | 16.9 | 0.45 | 3.4 |
| K-1420 OU | PCB-1254 | 7.35 | 0.066 | 111.4 | 0.66 | 11.1 |
| K-1420 OU | Uranium | 22.04 | 3.77 | 5.8 | 7.5 | 2.9 |
| K-1420 OU | Vanadium | 11.00 | 0.54 | 20.4 | 5.4 | 2.0 |
| K-1420 OU | Zinc | 528.90 | 452 | 1.2 | 905 | 0.6 |
| | | | | | | |
| WAG 5 | Mercury | 0.8211 | 0.09 | 9.12 | 0.45 | 1.82 |
| WAG 5 | Selenium | 0.5280 | 0.096 | 5.50 | 0.94 | 0.55 |
| WAG 5 | Vanadium | 2.8500 | 0.538 | 5.30 | 5.4 | 0.53 |
| WAG 5 | Zinc | 614.677 | 452.43 | 1.36 | 905 | 0.68 |
| WAG 5 | Total PCBs | 0.3193 | 0.066 | 4.84 | 0.66 | 0.48 |

WAG 5 Source: Baseline Ecological Risk Assessment Report for Waste Area Grouping 5 at Oak Ridge National Laboratory.

**Table G.19. HQs for contaminants of potential concern for the woodcock on the ORR**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| BCVOU1 | 4,4-DDE | 0.0085 | 0.0072 | 1.18 | 0.072 | 0.12 |
| BCVOU1 | 4,4-DDT | 0.0085 | 0.0072 | 1.18 | 0.072 | 0.12 |
| BCVOU1 | Barium | 55.47 | 17.7 | 3.13 | 35.4 | 1.57 |
| BCVOU1 | Cadmium | 39.98 | 2.6 | 15.38 | 36 | 1.11 |
| BCVOU1 | Copper | 140.24 | 65 | 2.16 | 85.6 | 1.64 |
| BCVOU1 | Lead | 42.80 | 1.03 | 41.55 | 10 | 4.28 |
| BCVOU1 | Mercury | 141.62 | 0.011 | 12874.85 | 0.109 | 1299.30 |
| BCVOU1 | PCB-1254 | 14.56 | 0.31 | 46.95 | 3.07 | 4.74 |
| BCVOU1 | PCB-1260 | 36.82 | 0.31 | 118.78 | 3.07 | 11.99 |
| BCVOU1 | Zinc | 4888.41 | 30.8 | 158.71 | 278 | 17.58 |

**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| LEFPC | Barium | 17.90 | 17.7 | 1.01 | 35.4 | 0.51 |
| LEFPC | Cadmium | 17.30 | 2.6 | 6.65 | 36 | 0.48 |
| LEFPC | Lead | 4.84 | 1.03 | 4.70 | 10 | 0.48 |
| LEFPC | Mercury | 185.06 | 0.011 | 16823.76 | 0.109 | 1697.81 |
| LEFPC | PCB-1254 | 1.22 | 0.31 | 3.95 | 3.07 | 0.40 |
| LEFPC | PCB-1260 | 2.54 | 0.31 | 8.20 | 3.07 | 0.83 |
| LEFPC | Selenium | 49.59 | 0.9 | 55.10 | 1.7 | 29.17 |
| LEFPC | Zinc | 716.88 | 30.8 | 23.28 | 278 | 2.58 |
| K-1407 OU | Aluminum | 2952.87 | 101.2 | 29.18 | 33 | 89.48 |

**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| K-1407 OU | Cadmium | 8.00 | 2.6 | 3.08 | 36 | 0.22 |
| K-1407 OU | Lead | 2.60 | 1.03 | 2.52 | 10 | 0.26 |
| K-1407 OU | Mercury | 28.45 | 0.011 | 2586.30 | 0.109 | 261.00 |
| K-1407 OU | Selenium | 40.74 | 0.9 | 45.27 | 1.7 | 23.97 |
| K-1407 OU | Zinc | 278.09 | 30.8 | 9.03 | 278 | 1.00 |
| WAG 1 | Boron | 138.76 | 49.1 | 2.83 | 171 | 0.81 |
| WAG 1 | Cadmium | 7.31 | 2.6 | 2.81 | 36 | 0.20 |
| WAG 1 | Lead | 3.65 | 1.03 | 3.54 | 10 | 0.36 |
| WAG 1 | Mercury | 8.23 | 0.011 | 747.87 | 0.109 | 75.47 |
| WAG 1 | PCB-1254 | 2.41 | 0.31 | 7.76 | 3.07 | 0.78 |

**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| WAG 1 | PCB-1260 | 1.24 | 0.31 | 4.00 | 3.07 | 0.40 |
| WAG 1 | Selenium | 95.94 | 0.9 | 106.60 | 1.7 | 56.44 |
| WAG 1 | Zinc | 455.62 | 30.8 | 14.79 | 278 | 1.64 |
| WAG 6 | Barium | 19.75 | 17.7 | 1.12 | 35.4 | 0.56 |
| WAG 6 | Cadmium | 10.60 | 2.6 | 4.08 | 36 | 0.29 |
| WAG 6 | Tin | 7.03 | 6.2 | 1.13 | 15.4 | 0.46 |
| UEFPC OU 2 | Aluminum | 6708.62 | 101.2 | 66.29 | 33 | 203.29 |
| UEFPC OU 2 | Barium | 78.12 | 17.7 | 4.41 | 35.4 | 2.21 |
| UEFPC OU 2 | Lead | 19.70 | 1.03 | 19.12 | 10 | 1.97 |

**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| UEFPC OU 2 | Zinc | 1237.85 | 30.8 | 40.19 | 278 | 4.45 |
| BC OU 2 | Aluminum | 3692.72 | 101.2 | 36.49 | 33 | 111.90 |
| BC OU 2 | Arsenic | 19.57 | 8.76 | 2.23 | 21.9 | 0.89 |
| BC OU 2 | Barium | 21.20 | 17.7 | 1.20 | 35.4 | 0.60 |
| BC OU 2 | Cadmium | 3.19 | 2.6 | 1.23 | 36 | 0.09 |
| BC OU 2 | Lead | 9.99 | 1.03 | 9.70 | 10 | 1.00 |
| BC OU 2 | Mercury | 338.27 | 0.011 | 30751.62 | 0.109 | 3103.37 |
| BC OU 2 | Selenium | 10.19 | 0.9 | 11.32 | 1.7 | 5.99 |
| BC OU 2 | Zinc | 644.50 | 30.8 | 20.93 | 278 | 2.32 |

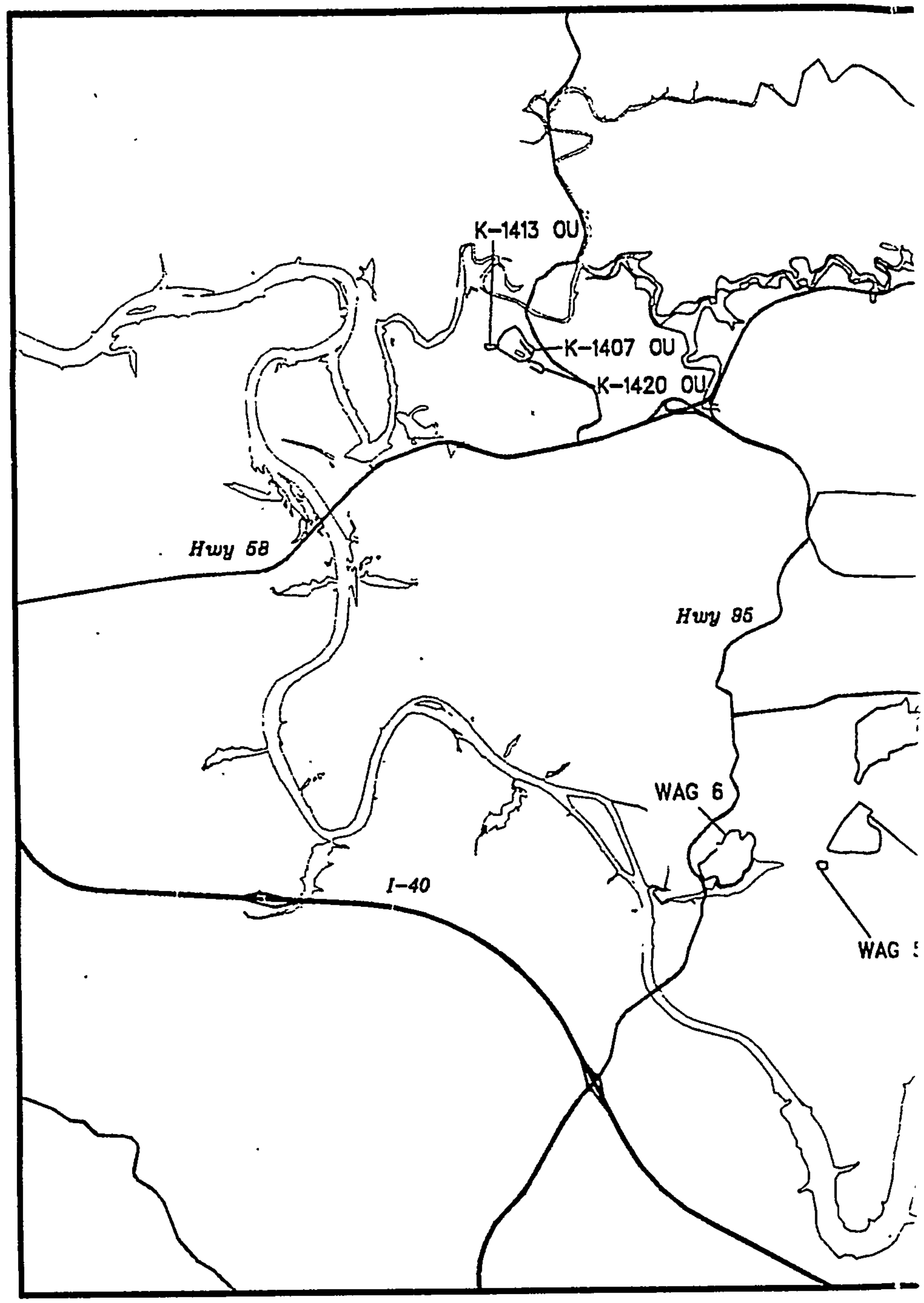
**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| SCF | Barium | 19.24 | 17.7 | 1.09 | 35.4 | 0.54 |
| SCF | Cadmium | 27.61 | 2.6 | 10.62 | 36 | 0.77 |
| SCF | Lead | 4.11 | 1.03 | 3.99 | 10 | 0.41 |
| SCF | Mercury | 3.80 | 0.011 | 345.39 | 0.109 | 34.86 |
| SCF | PCB-1260 | 0.3791 | 0.31 | 1.22 | 3.07 | 0.12 |
| SCF | Selenium | 16.89 | 0.9 | 18.76 | 1.7 | 9.93 |
| SCF | Zinc | 629.89 | 30.8 | 20.45 | 278 | 2.27 |
| K-1420 OU | Aluminum | 5069.11 | 101.2 | 50.09 | 33 | 153.61 |
| K-1420 OU | Lead | 7.13 | 1.03 | 6.92 | 10 | 0.71 |
| K-1420 OU | Mercury | 1.91 | 0.011 | 173.91 | 0.109 | 17.55 |

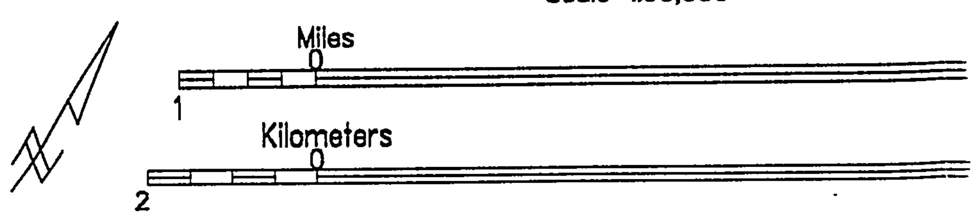
**Table G.19 (continued)**

| Location | Analyte | Total exposure (mg/kg/d) | NOAEL toxicity benchmark (mg/kg/d) | NOAEL HQ | LOAEL toxicity benchmark (mg/kg/d) | LOAEL HQ |
|---|---|---|---|---|---|---|
| K-1420 OU | PCB-1254 | 9.25 | 0.31 | 29.84 | 3.07 | 3.01 |
| K-1420 OU | Zinc | 664.77 | 30.8 | 21.58 | 278 | 2.39 |
| K-1414 | Di-n-butlyphthalate | 0.1876 | 0.1 | 1.88 | 1 | 0.19 |
| WAG 5 | Lead | 8.8462 | 3.35 | 2.64 | 10 | 0.88 |
| WAG 5 | Mercury | 1.0111 | 0.011 | 91.92 | 0.109 | 9.28 |
| WAG 5 | Zinc | 756.3303 | 30.8 | 24.56 | 278 | 2.72 |
| WAG 5 | Di-N-butylphtalate | 0.1182 | 0.1 | 1.18 | 1 | 0.12 |

WAG 5 Source: Baseline Ecological Risk Assessment Report for Waste Area Grouping 5 at Oak Ridge National Laboratory.




Scale 1:90,000



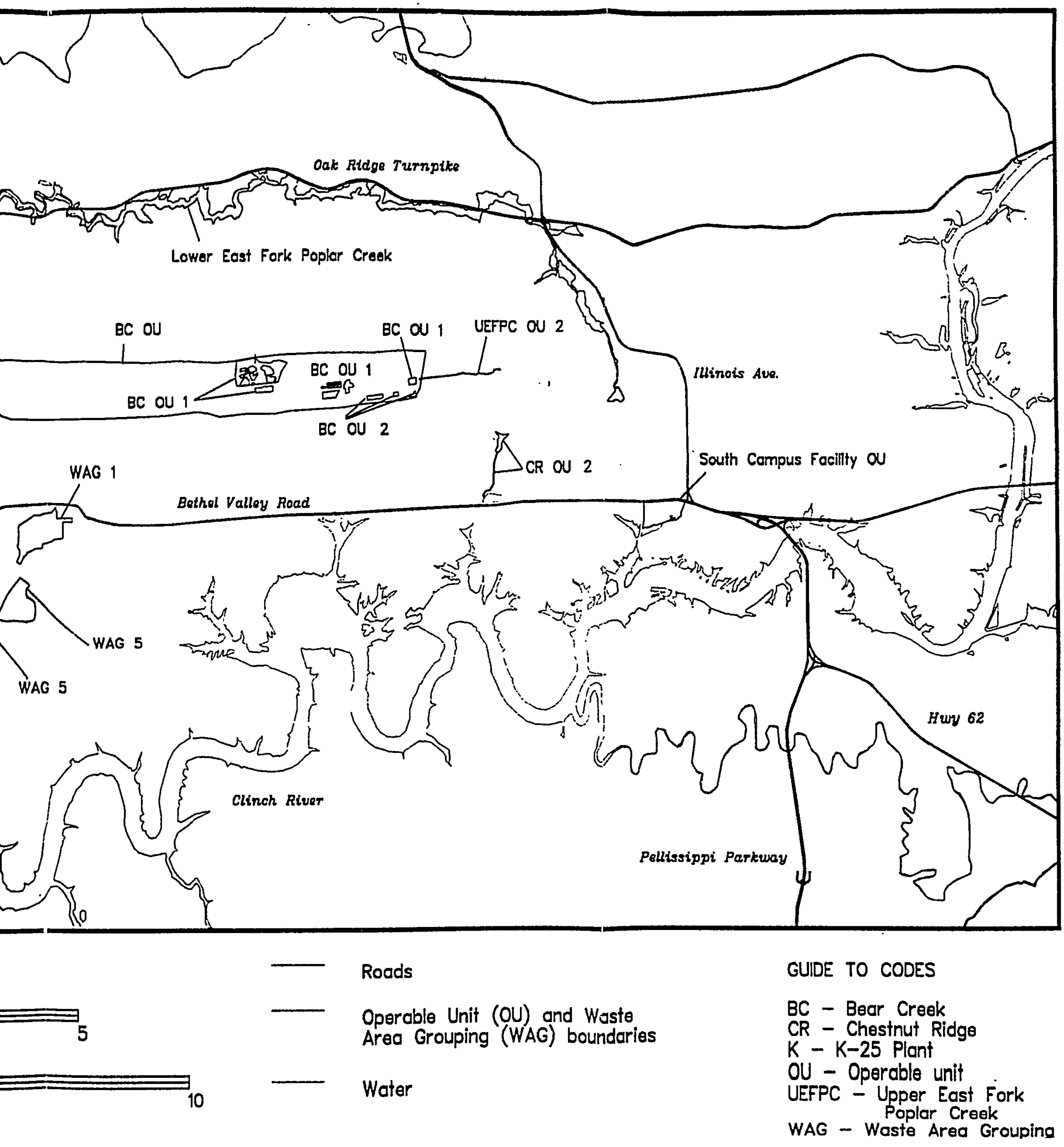



**Fig.G.1. Locations of OUs evaluated as part of the ORR-wide assessment of risk to vermivores and herbivores.**

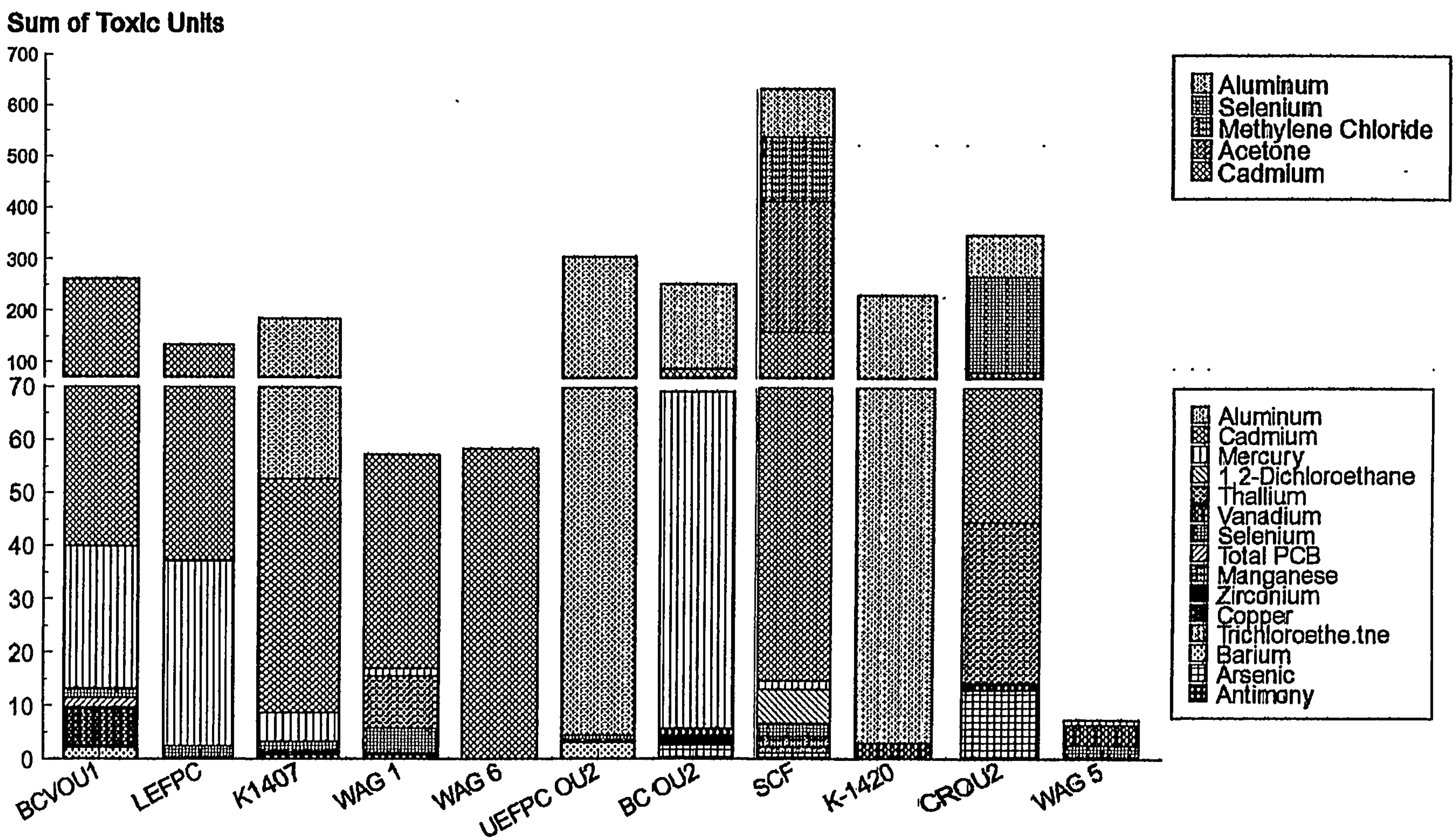



**Fig. G.2. Sum of NOAEL-based toxic units for evaluation of risks to white-tailed deer on the ORR.** Order of contaminants in legend corresponds to order of contaminants in bars.

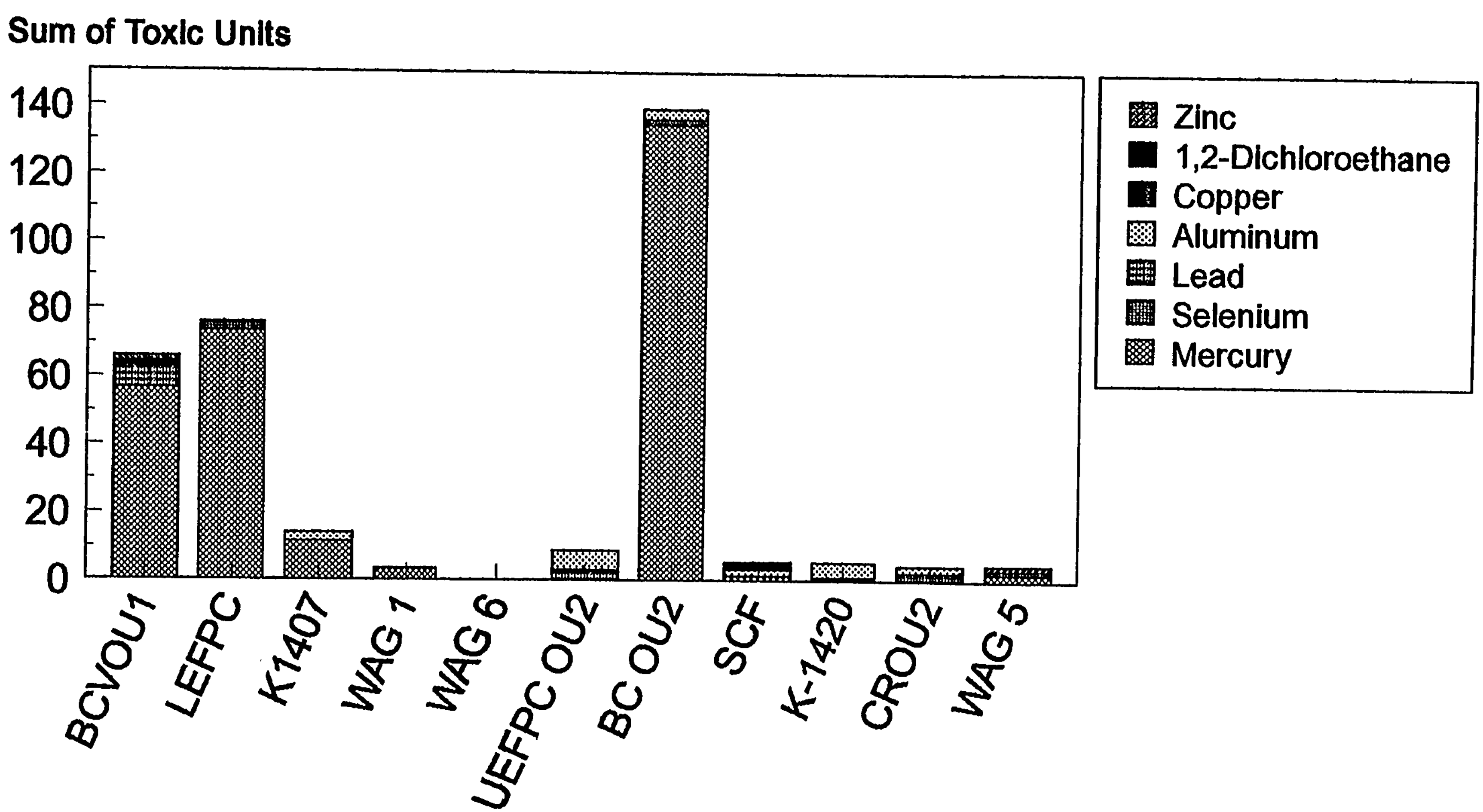



**Fig. G.3. Sum of NOAEL-based toxic units for evaluation of risks to wild turkey on the ORR.** Order of contaminants in legend corresponds to order of contaminants in bars.

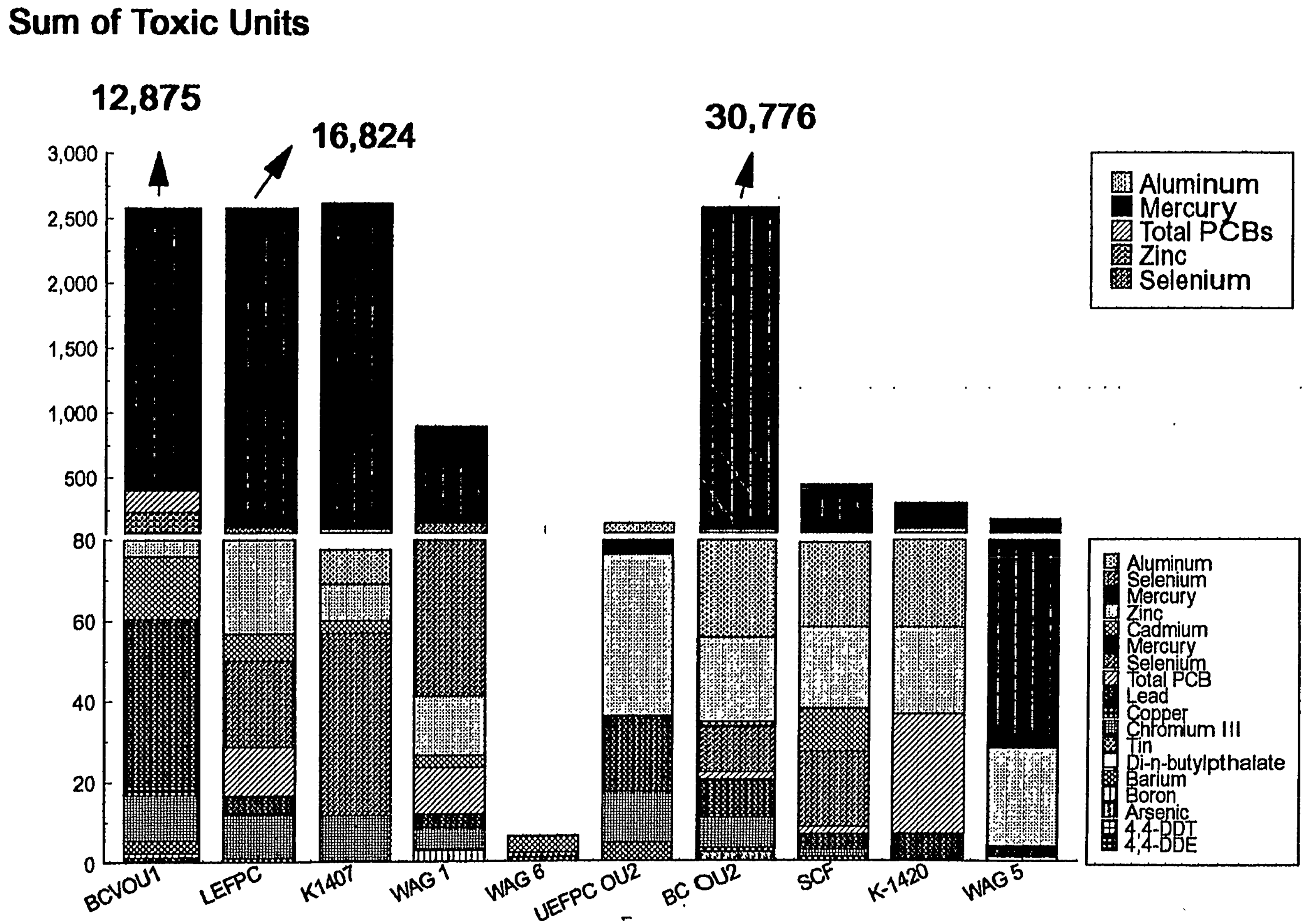



**Fig. G.4. Sum of NOAEL-based toxic units for evaluation of risks to American woodcock on the ORR.** Order of contaminants in legend corresponds to order of contaminants in bars.

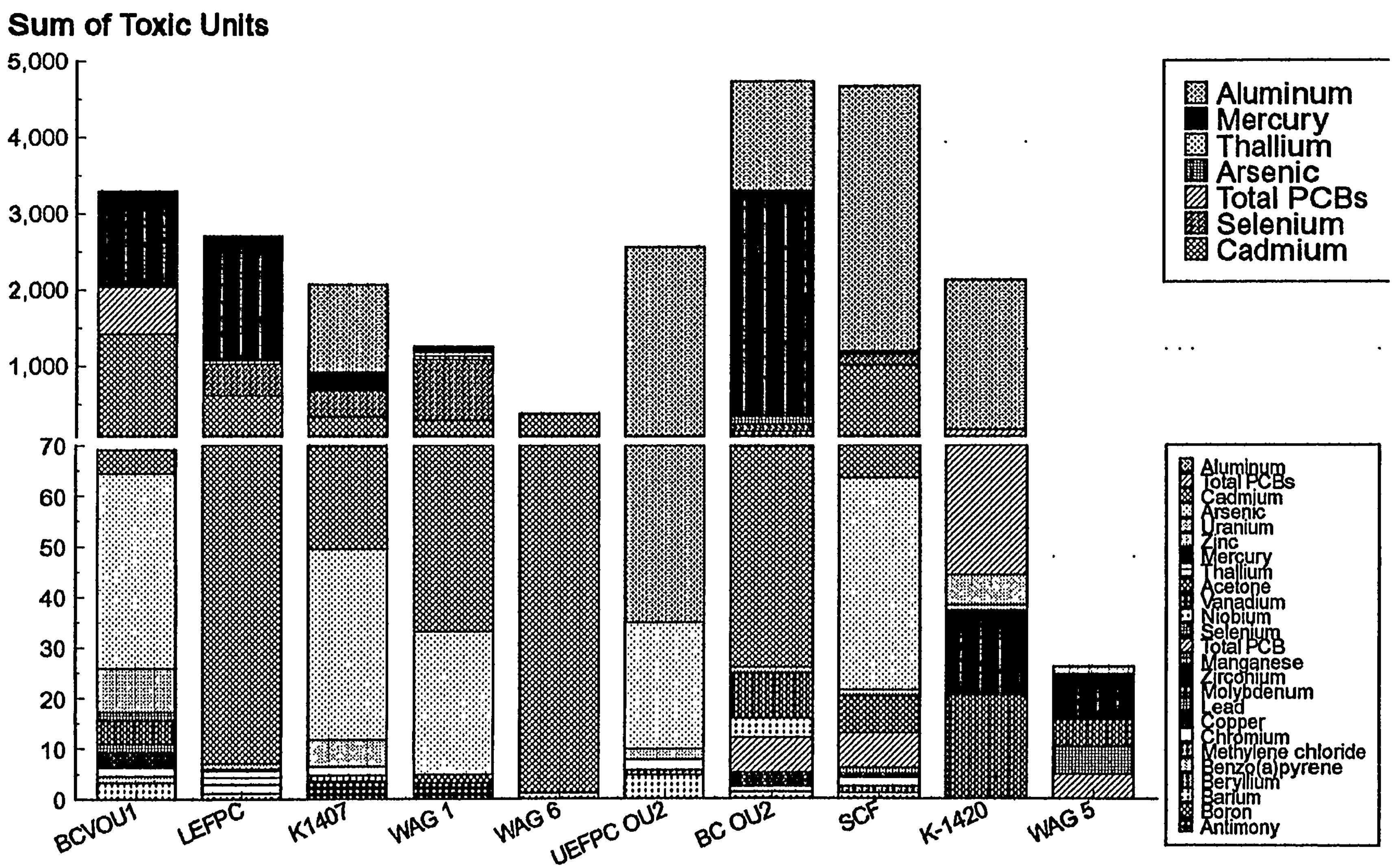



**Fig. G.5.** **Sum of NOAEL-based toxic units for evaluation of risks to short-tailed shrew on the ORR.** Order of contaminants in legend corresponds to order of contaminants in bars.

**DISTRIBUTION**

1. T. L. Ashwood
2. L. V. Asplund
3. L. W. Barnthouse
4. L. A. Baron
5. M. L. Bell
6. H. L. Boston
7. R. B. Cook
8. D. G. Cope
9. V. H. Dale
10. R. A. Efroymson
11. R. L. Graham
12. S. G. Hildebrand
13. W. R. Hill
14. C. T. Hunsaker
15. B. L. Jackson
16. D. S. Jones
17. J. M. Loar
18. J. R. Lyons

19–21. D. M. Matteo
22–23. P. T. Owen
24. P. D. Parr
25. M. J. Peterson
26–28. A. S. Quist
29. B. E. Sample
30. F. E. Sharples
31. G. R. Southworth
32. G. W. Suter
33. R. A. Washington-Allen
34. J. W. Webb
35. ER Central Document Management Center—RC
36. ORNL Laboratory Records
37. K-25 Site Records
38. Y-12 Plant Records
39. Charles Hadden, Science Applications International Corporation, P.O. Box 2501, 301 Laboratory Road, Oak Ridge, TN 37831
40–54. Nelson Lingle, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
55. Office of Assistant Manager for Energy Research and Development, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
56–57. R. L. Nace, Branch Chief, Nonenrichment Facilities, Oak Ridge Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, EM-423, Trevion 2, U.S. Department of Energy, Washington, DC 20585
58–77. Teresa Perry, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
78–79. H. M. Thron, Chief, Enrichment Facilities, Oak Ridge Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, EM-423, Trevion 2, U.S. Department of Energy, Washington, DC 20585